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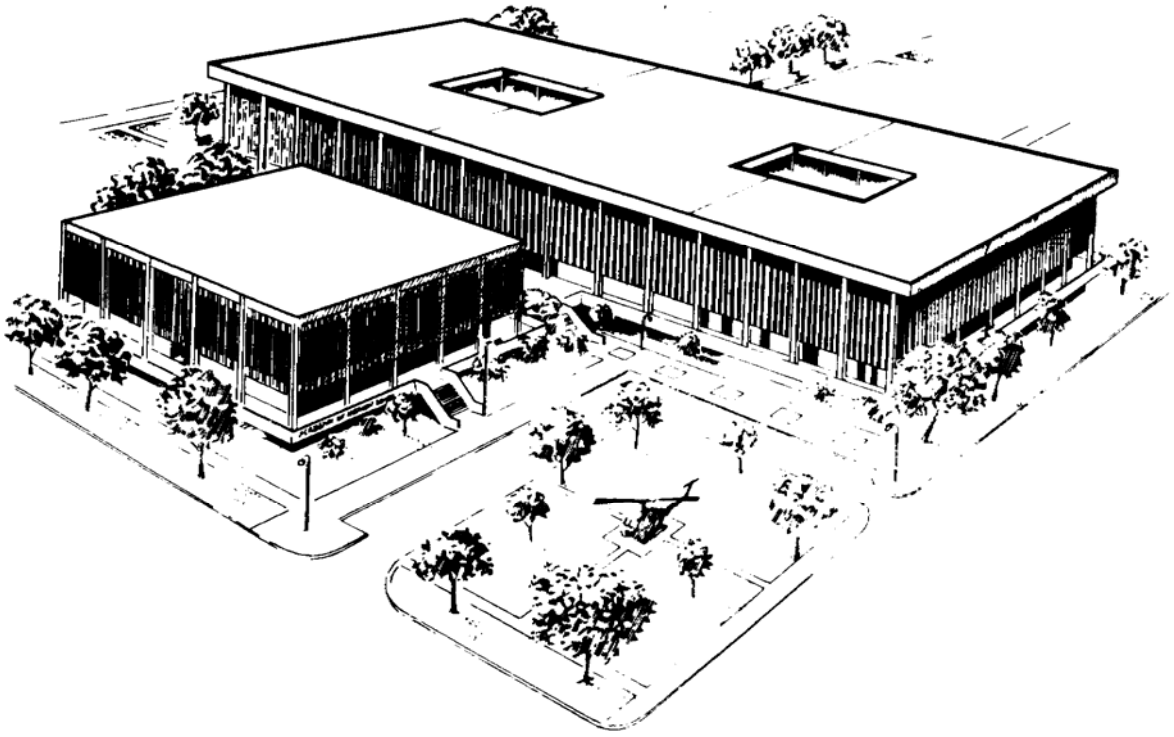

CARDIOPULMONARY RESUSCITATION

SUBCOURSE MD0532 EDITION 200

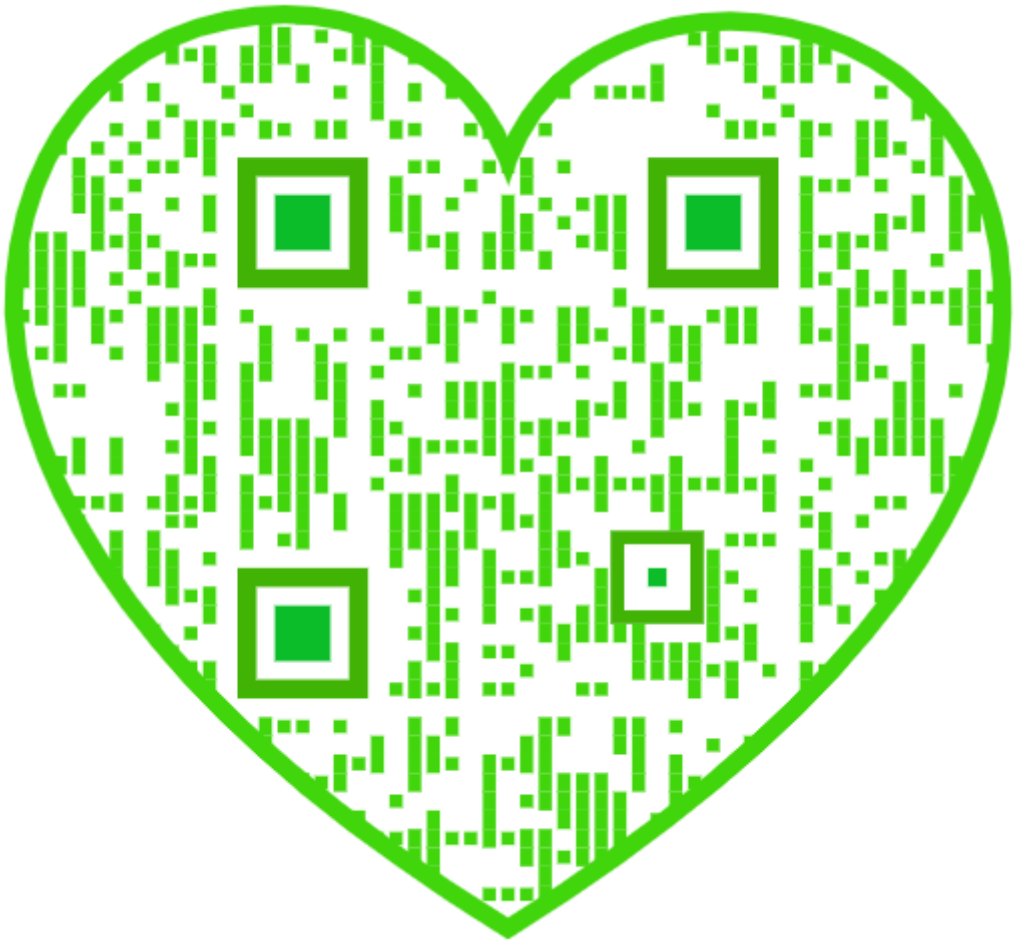

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TABLE OF CONTENTS

Lesson		Paragraphs
	INTRODUCTION	
1	REVIEW OF THE CIRCULATORY AND RESPIRATORY SYSTEMS	1-1--1-6
	Exercises	
2	HEART ATTACK AND CARDIOPULMONARY RESUSCITATION	2-1--2-9
	Exercises	
3	INITIATE RESCUE BREATHING ON AN ADULT	3-1--3-12
	Exercises	
4	PERFORM CARDIOPULMONARY RESUSCITATION ON AN ADULT	4-1--4-5
	Exercises	
5	REMOVE AN UPPER AIRWAY OBSTRUCTION IN AN ADULT	5-1--5-7
	Exercises	
6	PERFORM CARDIOPULMONARY RESUSCITATION ON A CHILD OR INFANT	6-1--6-7
	Exercises	
7	REMOVE AN AIRWAY OBSTRUCTION IN A CHILD OR INFANT	7-1--7-4
	Exercises	
8	ADMINISTER CPR AND AUTOMATED EXTERNAL DEFIBRILLATION ON AN UNCONSCIOUS CASUALTY WITH SUSPECTED CARDIAC ARREST	8-1--8-5
	Exercises	

CORRESPONDENCE COURSE OF

THE U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL

SUBCOURSE MD0532

CARDIOPULMONARY RESUSCITATION

INTRODUCTION

As a member of the Army Medical Department, you are expected to know how to perform basic lifesaving procedures in an emergency. Such emergencies can occur anywhere -- on the battlefield, in your home, in a restaurant, or on the highway. In such an emergency, a person's life may depend upon your knowledge of what to do and upon your ability to do the procedure properly and quickly.

This subcourse provides instruction which will enable you to remove an obstruction from a casualty's airway, restore respiration to a casualty who has stopped breathing, and restore blood circulation to a casualty whose heart has stopped beating. Instruction is provided for performing these procedures for an adult casualty, a child, and an infant. Study and know these procedures BEFORE you are faced with an emergency.

Subcourse Components:

The subcourse instructional material consists of the following:

Lesson 1, Review of the Circulatory and Respiratory Systems.
Lesson 2, Heart Attack and Cardiopulmonary Resuscitation.

Lesson 3, Initiate Rescue Breathing on an Adult.
Lesson 4, Perform Cardiopulmonary Resuscitation on an Adult.
Lesson 5, Remove an Upper Airway Obstruction in an Adult.
Lesson 6, Perform Cardiopulmonary Resuscitation on a Child or Infant.
Lesson 7, Remove an Airway Obstruction in a Child or Infant.
Lesson 8, Administer CPR and Automated External Defibrillation on an Unconscious Casualty with Suspected Cardiac Arrest.

Study Suggestions:

Here are some suggestions that may be helpful to you in completing this subcourse:

--Read and study each lesson carefully.
--Complete the subcourse lesson by lesson. After completing each lesson, work the exercises at the end of the lesson, marking your answers in this booklet.

--After completing each set of lesson exercises, compare your answers with those on the solution sheet that follows the exercises. If you have answered an exercise incorrectly, check the reference cited after the answer on the solution sheet to determine why your response was not the correct one.

Credit Awarded:

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Branch at Fort Sam Houston, Texas. Upon successful completion of the examination for this subcourse, you will be awarded 10 credit hours.

You can enroll by going to the web site http://atrrs.army.mil and enrolling under "Self Development" (School Code 555).

A listing of correspondence courses and subcourses available through the Nonresident Instruction Section is found in Chapter 4 of DA Pamphlet 350-59, Army Correspondence Course Program Catalog. The DA PAM is available at the following website: http://www.usapa.army.mil/pdffiles/p350-59.pdf.

LESSON ASSIGNMENT

LESSON 1	Review of the Circulatory and Respiratory Systems.
TEXT ASSIGNMENT	Paragraphs 1-1 through 1-6.
LESSON OBJECTIVES	After completing this lesson, you should be able to:
	1-1. Identify the general functions of the circulatory system.
	1-2. Identify the components of the circulatory system and their functions.
	1-3. Identify the general functions of the respiratory system.
	1-4. Identify the components of the respiratory system and their functions.
SUGGESTION	After you have completed the text assignment, work the exercises at the end of this lesson before beginning the next lesson. These exercises will help you achieve the lesson objectives.

LESSON 1

REVIEW OF THE CIRCULATORY AND RESPIRATORY SYSTEMS

1-1. DEFINITIONS

Some of the terms used in this subcourse are defined below.

a. **Casualty**. The casualty is the person with the medical problem, such as a person who is not breathing. When being treated by medical personnel, the casualty may be referred to as a patient.

b. **Rescuer.** The rescuer is the person who is assisting the casualty; for example, the person giving mouth-to-mouth resuscitation to a casualty who is not breathing. In this subcourse, you are the rescuer.

c. **Airway.** The airway consists of the body structures through which air from the atmosphere passes while going to the lungs.

d. **Sign.** A sign is anything that the rescuer can tell about the casualty's condition by using his (the rescuer's) own senses. For example, a rescuer can see the casualty's chest rise and fall, hear the sounds made by a casualty when he breathes, and feel the casualty's pulse.

e. **Symptom.** A symptom is any change from the norm which is felt by the casualty but which cannot be directly or objectively sensed by the rescuer. Examples of symptoms felt by the casualty include chest pain, nausea, and headache. An injury can produce both signs and symptoms. If you bump your leg against a chair, for example, a bruise may develop. The bruise is a sign of the injury since other people can see the bruise. The pain you feel is a symptom since other people cannot feel your pain.

1-2. IMPORTANCE OF THE CIRCULATORY SYSTEM

The human body is composed of cells. The average adult human's body is made up of around eighty trillion (80,000,000,000,000) living cells. Cells need energy to survive, repair themselves, perform their functions, and reproduce. Cells obtain this energy through cellular respiration; that is, they combine a source of potential energy with oxygen to liberate energy. The sources of potential energy come from the food (carbohydrates, fats, and proteins) that are processed into usable units by the body's digestive system (stomach, small intestine, liver, pancreas, and so forth). The oxygen comes from the air that is inhaled by the lungs. Oxygen in the lungs and food in the intestine cannot help the muscles and other cells unless the oxygen and food can be delivered to those cells. Delivering oxygen and food to the cells is the function of the blood in the body's circulatory system. The circulatory system also takes waste products (by-products of cellular respiration) from the cells and delivers them to organs (lungs and kidneys) where the wastes can be expelled from the body.

1-3. THE CIRCULATORY SYSTEM

The circulatory system consists of the heart, blood vessels, and blood. The circulatory system brings oxygen and nutrients to the body's cells and carries away waste products. The circulatory system is also called the cardiovascular system ("cardio-" means heart; "-vascular" means vessels.)

a. **Heart.** The heart (figure 1-1) is a strong, muscular organ that, by its rhythmic contractions, acts as a force pump maintaining blood circulation. The heart is about the size of a fist and is located in the lower left-central part of the chest cavity.

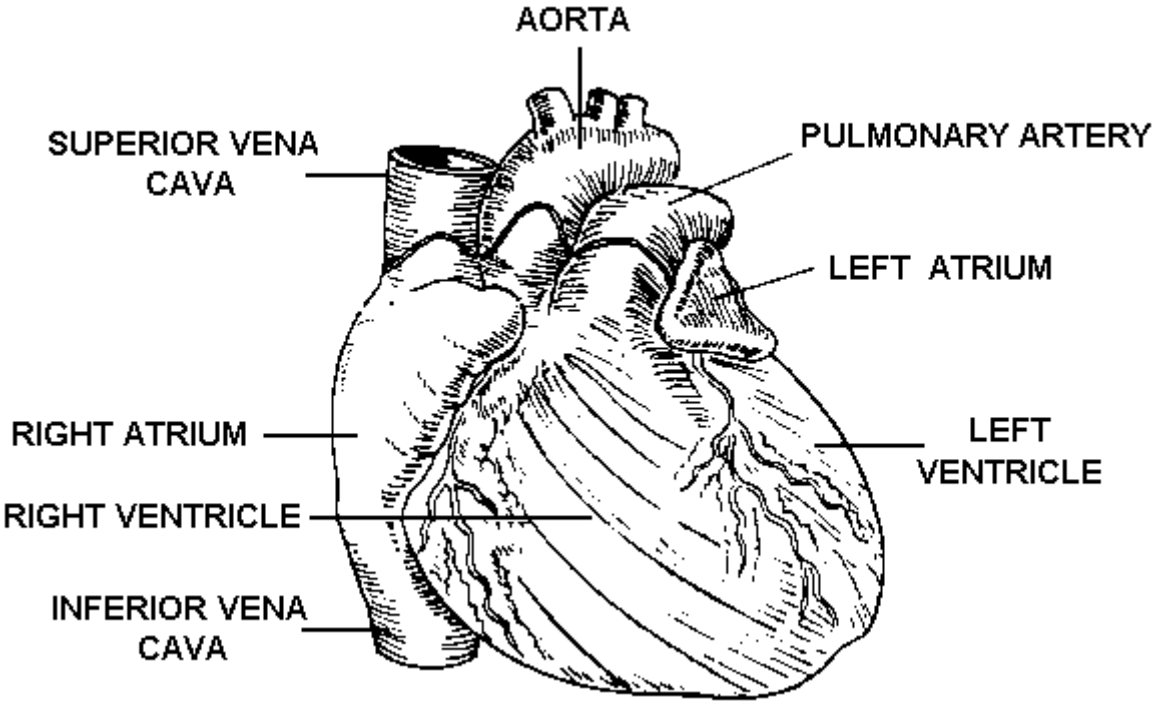


Figure 1-1. The human heart (front view).

(1) Layers. The heart consists of three layers.

(a) The myocardium is the middle layer. It is composed of the actual heart muscles. ("Myo-" means muscle; "cardium" means heart.)

(b) The pericardium is the outer layer. It is a double-walled sac that surrounds the heart muscles. ("Peri-" means around.)

(c) The endocardium is the inner layer. It forms the inner lining of the four chambers. ("Endo-" means within.)

(2) Chambers. The heart can be described as being two pumps. Each side (right half and left half) of the heart has a receiving chamber for the blood (the atrium) and a pumping chamber (the ventricle). The two halves of the heart are separated by a wall-like structure called the interventricular septum.

NOTE: The plural of atrium is atria.

(3) Sinoatrial node. The sinoatrial (SA) node is a small bundle of nerve tissue located at the junction of the superior vena cava and the right atrium. The sinoatrial node is a natural pacemaker that produces an electrical stimulus. This electrical stimulus causes the muscles of the ventricles to contract and pump blood.

b. **Blood Vessels.** The blood vessels are firm, elastic, muscular tubes that carry the blood away from the heart and back to the heart again.

(1) Blood circulation systems. Since the heart is divided into two parts (the right half consisting of the right atrium and the right ventricle and the left half consisting of the left atrium and left ventricle), it is not surprising to find that there are actually two blood circulatory systems--the systemic and the pulmonary.

(a) Systemic. The systemic (general) circulatory system is the larger of the two systems. It takes the blood pumped by the left ventricle to all parts of the body and returns the blood to the right atrium. The oxygen content of the blood is high when it leaves the heart through the left ventricle and is low when it returns to the right atrium.

(b) Pulmonary. The pulmonary circulatory system takes the blood pumped by the right ventricle to the lungs and returns the blood to the left atrium. The oxygen content of the blood is low when it leaves the heart through the right ventricle and high when it returns to the left atrium.

(2) Types of blood vessels. Both the systemic and the pulmonary circulatory systems are composed of three major types of blood vessels--arteries, capillaries, and veins.

(a) Arteries. The arteries carry blood pumped by the ventricles away from the heart. The arteries of the systemic circulatory system carry oxygenated (oxygen rich) blood to body tissues. The pulmonary arteries carry deoxygenated (oxygen-poor) blood to the lungs. Arteries have the capacity to constrict and dilate. This constricting and dilating helps to regulate the blood pressure.

(b) Capillaries. Originally, the arteries are large blood vessels. Soon, however, they divide into smaller branches. These branches then divide again and again. With each division, the blood vessels become smaller and smaller. Finally, the blood vessels are so small that only one red blood cell can pass through at a time. When they reach this size, the blood vessels are called capillaries. When a red blood cell enters the capillaries, it is free to perform its primary functions. In the pulmonary system, red blood cells give up carbon dioxide to the lungs and pick up oxygen. In the systemic system, red blood cells give oxygen and nutrients to the cells and pick up carbon dioxide and other waste products.

(c) Veins. Capillaries join together to form larger blood vessels, which then combine to form even larger blood vessels. These blood vessels are called veins. Veins carry the blood back to the heart. The veins of the systemic system carry oxygen-poor blood to the right atrium. The veins of the pulmonary system carry oxygen-rich blood to the left atrium. The veins are not as thick as the arteries, and they will collapse when severed. Many veins have valves, which keep blood from flowing backward (away from the heart). The term "vena" denotes a vein.

c. **Blood**. Blood is a viscous (thick), reddish fluid. When the blood is oxygenated (oxygen-rich), it is bright red. When the blood is low in oxygen content, it is a darker red. When the darker color is seen through a layer of skin tissue, it appears to be bluish. Blood is composed of fluid and solids.

(1) Plasma. The liquid part of the blood is called plasma. It is straw-colored (pale yellow) and carries the solid components of the blood such as erythrocytes, leukocytes, and thrombocytes.

(2) Erythrocytes. Erythrocytes (also called red blood cells or RBC) transport oxygen from the lungs and nutrients from the small intestine to the cells of the body. They also transport carbon dioxide and other waste materials from the body's cells to the lungs and kidneys where the waste products are removed and expelled.

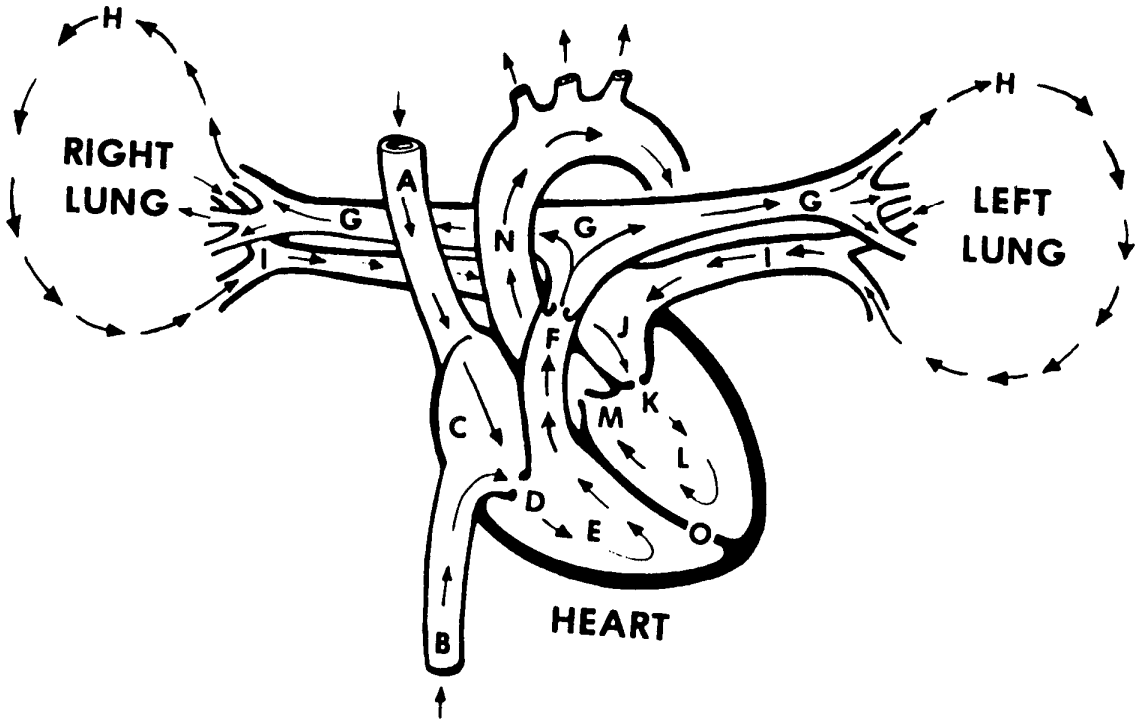
(3) Leukocytes. Leukocytes (also called white blood cells or WBC) assist in the body's defense against disease by attacking and destroying bacteria and other foreign particles in the blood and body tissues.

(4) Thrombocytes. Thrombocytes (also called platelets) help to stop bleeding from a damaged blood vessel. Although thrombocytes normally show no tendency to coagulate (clot) in the blood, they change character when they approach a cut or tear in a blood vessel. The thrombocytes then combine to form a soft clot where the vessel wall is broken. This clot soon hardens to form a plug to stop the loss of blood.

1-4. BLOOD FLOW

In order to summarize how blood flows in the body, let's take a trip through the body's circulatory system (figure 1-2). We will enter the system at the vena cava.

a. **Vena Cava.** There are two major blood veins, which empty into the right atrium. The superior vena cava carries oxygen-poor blood coming from the head, arms, and chest. The inferior vena cava returns oxygen-poor blood from the lower trunk and legs.



A. Superior vena cava	I. Pulmonary veins
B. Inferior vena cava	J. Left atrium
C. Right atrium	K. Mitral valve
D. Tricuspid valve	L. Left ventricle
E. Right ventricle	M. Aortic valve
F. Pulmonary valve	N. Aorta
G. Pulmonary arteries	O. Interventricular septum
H. Lungs	

Figure 1-2. Blood flow to and from the heart (not drawn to scale, front view).

b. **Right Atrium.** The right atrium receives blood from the superior vena cava and the inferior vena cava. When the right ventricle relaxes (that is, after it has contracted and pumped blood), blood flows from the right atrium into the right ventricle through the tricuspid valve. The tricuspid valve is formed so that blood cannot flow back into the right atrium when the right ventricle contracts.

c. **Right Ventricle.** When the right ventricle is filled with blood, it receives an impulse from the sinoatrial node. This impulse causes the muscles of the right ventricle to contract. This contraction causes the inside of the ventricle (the space where the blood is) to become smaller. The increased pressure forces blood out of the ventricle and into the pulmonary artery. The pulmonary valve located at the beginning of the pulmonary artery keeps blood from flowing back into the right ventricle when the ventricle relaxes and returns to its normal size.

d. **Lungs (Pulmonary System).** The pulmonary artery divides into two arteries. One artery travels to the right lung while the other artery travels to the left lung. The arteries divide until they reach the capillary stage. The capillaries surround the alveoli (air sacs) of the lungs. There the oxygen-poor blood gets rid of carbon dioxide and picks up oxygen from the air in the alveolus. The blood, now high in oxygen content, then returns to the left atrium through the pulmonary veins.

e. **Left Atrium.** The left atrium receives blood from the lungs through two pulmonary veins. When the left ventricle relaxes after having contracted, the blood flows from the left atrium into the left ventricle through the mitral valve. The mitral valve keeps blood from flowing back into the left atrium when the left ventricle contracts.

f. **Left Ventricle.** After the left ventricle is filled with oxygen-rich blood, it receives an impulse from the sinoatrial node, which causes it to contract and pump blood into the large artery call the aorta. When the blood enters the aorta, it passes through the aortic valve. This valve keeps the blood from flowing back into the heart once the left ventricle relaxes.

g. **Body (Systemic System).**

(1) Some arteries branch off the aorta to provide the brain, upper body, and heart with blood. Blood returns to the heart from these areas through the superior vena cava.

NOTE: If blood flow to the brain stops and is not restored (either the casualty's heart starts beating on its own or cardiopulmonary resuscitation is administered), the brain will begin to die in six to ten minutes.

(2) The aorta turns down and divides into smaller arteries which go to the lower parts of the body. Some of the blood picks up fluids and nutrients from the intestines. Some of the blood passes through the liver and kidneys which remove bacteria and other unwanted substances from the blood. The blood returns to the heart from these areas through the inferior vena cava.

1-5. THE RESPIRATORY SYSTEM

The respiratory system consists of two lungs and the respiratory tract that carries air to and from the lungs (figure 1-3). When a person inhales, the air enters the nose or mouth, travels down the trachea, and into the two bronchi. Each bronchus divides into smaller and smaller air tubes. Finally, the air reaches the alveoli (air sacs). The red blood cells in the capillaries surrounding the alveoli absorb oxygen from the air and give off carbon dioxide, which passes into the alveoli. When a person exhales, the air travels from the alveoli through the air tubes, up the trachea, and out the nose or mouth. Of course, not all of the air inhaled reaches the alveoli nor is all of the oxygen removed from the air in the alveoli. The average adult takes in about 500 milliliters (ml) of air each time he inhales and he exhales the same amount. Even after the person exhales, the lungs still contain about 2300 ml of air. The anatomy (structures) and the physiology (functions) of the respiratory system are briefly discussed below.

a. **Nose.** The nose is composed of two nostrils (openings) and two nasal cavities (air chambers above the roof of the mouth and below the cranium). A structure called the nasal septum separates the right nostril and nasal cavity from the left nostril and nasal cavity. The nose warms, moistens, and filters the inhaled air. Special nerve endings in the upper part of the nasal cavities provide the sense of smell.

b. **Pharynx.** The pharynx is a part of the throat that is part of both the respiratory system and the digestive system. The pharynx is divided into three parts. The nasopharynx (upper part) connects with the nasal chambers. The oropharynx (middle part) connects with the oral cavity (mouth). The laryngopharynx (lower part) connects with the larynx (respiratory system) and the esophagus (digestive system).

c. **Epiglottis.** The epiglottis is a flap that covers the entrance to the larynx when a person swallows. This prevents food from entering the larynx instead of the esophagus. When a person inhales, the entrance to the larynx is not covered and air enters the larynx. If a foreign object enters the airway, it can block the airway and cause breathing to stop.

d. **Larynx.** The larynx is a box-like structure composed of cartilage, ligaments, and muscles that sits on top of the trachea. The larynx contains the vocal cords, which produce the voice; therefore, it is sometimes called the voice box. It is also called the Adam's apple because of the bulge it causes in the throat.

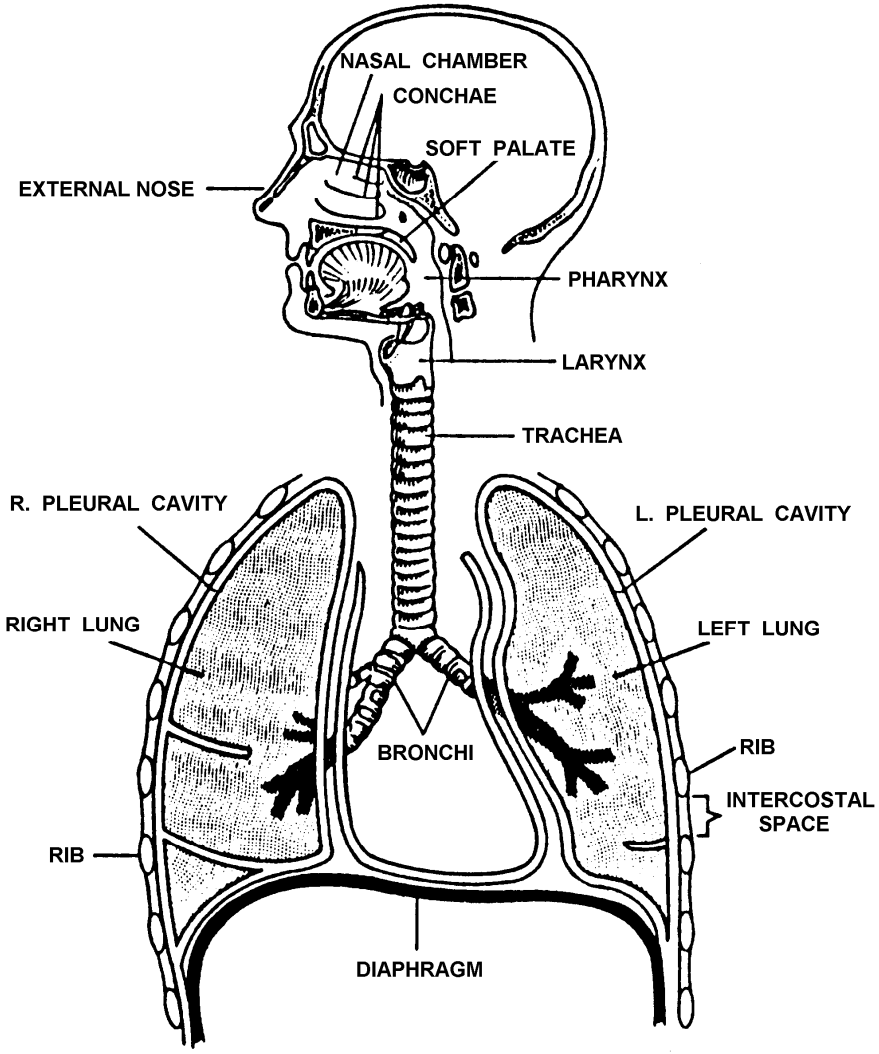


Figure 1-3. The respiratory system.

e. **Trachea.** The trachea (windpipe) is a tube composed of horseshoe-shaped rings of cartilage. Cilia (hair-like projections) on the inner lining of the trachea help to filter air as it passes through the trachea to the bronchi.

f. **Bronchi**. The bronchi are two tube-like structures at the base of the trachea. One bronchus leads toward the right lung; the other bronchus leads toward the left lung. Like the trachea, the bronchi are composed of cartilaginous rings and are lined with a mucous membrane.

g. **Bronchioli**. The bronchi divide and subdivide until they become small air tubes one millimeter or less in diameter call bronchioli. The bronchioli continue to subdivide until they become very small tubes ending in alveoli.

h. **Alveoli**. Alveoli are tiny, grape-like clusters of microscopic air sacs. Air enters the alveoli from the bronchioli. The wall of an alveolus is one cell layer thick. The alveolus is surrounded by equally thin capillaries. Oxygen (O_2) molecules from the air inside the alveolus travel through the alveolus and capillary walls to the blood within the capillary. The hemoglobin in the red blood cells captures the oxygen molecules and release carbon dioxide (CO_2) molecules. The carbon dioxide molecules and some water molecules travel from the blood, through the walls, and into the alveoli.

i. **Lungs**. The alveoli, bronchioli, and associated blood vessels make up two cone-like organs called lungs. The lungs are broad at their base (which rests on the diaphragm) and narrow at the apex (top). Each lung is surrounded by pleural membranes that prevent friction when the lung expands and contracts. The right lung is divided into three lobes; the left lung is divided into two lobes. The left lung is smaller than the right lung because the heart takes up space on the left side of the chest cavity.

1-6. MECHANICS OF BREATHING

Breathing refers to the process of moving air into and out of the lungs. The process is usually performed automatically (without conscious thought) by the respiratory control center located in the medulla oblongata of the brain stem. The normal range of breathing rates (one cycle consists of one inspiration and one exhalation) in an adult is 12 to 20 breaths per minute. Regular, easy breathing is referred to as eupnea. Difficulty in breathing is referred to as dyspnea.

a. **Inhalation**. During the inhalation (inspiration) phase of breathing, the diaphragm and the intercostal muscles contract. When the diaphragm muscle (located at the base of the lungs) contracts, it is pulled downward toward the abdomen. This flattening of the diaphragm enlarges the chest cavity. When the intercostal muscles (located between the ribs) contract, they lift the rib cage up and out (chest rises). This also enlarges the chest cavity. This expansion of the chest cavity causes the air pressure in the alveoli to decrease. Air from the outside environment rushes in through the nose or mouth to equalize the pressure.

b. **Exhalation**. During the exhalation (expiration) phase of breathing, the diaphragm and the intercostal muscles relax. When the diaphragm muscle relaxes, it resumes its dome-like shape (moves upward). When the intercostal muscles relax, they let the rib cage return to its original position (moves down and inward). Both of these actions cause the air pressure in the alveoli to increase and force air out of the lungs, through the airways, and out the nose or mouth.

Continue with Exercises

EXERCISES, LESSON 1

INSTRUCTIONS: Follow the special instructions for Exercise 1. In Exercises 2 through 10, circle the letter of the response that BEST completes the statement or BEST answers the question. After you have completed the exercises, turn to "Solutions to Exercises" at the end of the lesson exercises and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. Special Instructions. Trace the flow of blood through the body's blood circulatory system beginning when the blood leaves the left ventricle by numbering the following statements in the sequence in which they occur.

   a. ___ Blood flows from the vena cava into the right atrium.

   b. ___ Blood enters capillaries of the systemic system.

   c. ___ Blood pumped into pulmonary artery.

   d. 1 Blood pumped into the aorta.

   e. ___ Blood gives up carbon dioxide and picks up oxygen.

   f. ___ Blood enters veins of the systemic system.

   g. ___ Blood flows through the smaller arteries of the systemic system.

   h. ___ Blood enters veins of the pulmonary system.

   i. ___ Blood flows into right ventricle.

   j. ___ Blood enters capillaries of the pulmonary system.

   k. 13 Blood enters left ventricle.

   l. ___ Blood gives up oxygen and nutrients; picks up waste products.

   m. ___ Blood enters left atrium.

2. The actual muscle layer of the heart is the:

   a. Endocardium.

   b. Myocardium.

   c. Pericardium.

3. You are examining a casualty. He is perspiring heavily and complains of having a headache. Which of the following is correct?

   a. The heavy perspiration is a sign and the headache is a symptom.

   b. The heavy perspiration is a symptom and the headache is a sign.

   c. The heavy perspiration and the headache are both signs.

   d. The heavy perspiration and the headache are both signs.

4. The blood performs what vital function(s)?

   a. Transports oxygen from the lungs to the cells of the body.

   b. Transports nutrients from the digestive system to the cells of the body.

   c. Transports waste materials from the cells of the body to the lungs and kidneys.

   d. All of the above.

5. The chambers of the heart that pump blood into the arteries are the:

   a. Atria.

   b. Pulmonary and aortic valves.

   c. Vena cava.

   d. Ventricles.

6. The small air sacs in which oxygen travels from inside the sac to the blood and carbon dioxide travels from the blood to the inside sac are the:

   a. Alveoli.

   b. Bronchi.

   c. Capillaries

   d. Larynx.

7. The cells of the blood that carry oxygen are the :

   a. Erythrocytes.

   b. Leukocytes.

   c. Lymphocytes.

   d. Thrombocytes.

8. In an adult, a breathing rate of _____breaths per minute is considered to be normal.

   a. 5 to 7.

   b. 12 to 20.

   c. 32 to 45.

   d. 55 to 70.

9. You are breathing normally. When you exhale, you expel:

   a. All of the air in your lungs.

   b. About 80 percent of the air in your lungs.

   c. Slightly over 50 percent of the air in your lungs.

   d. About 20 percent of the air in your lungs.

10. What is the primary purpose of the tricuspid and mitral heart valves?

    a. They prevent blood flowing between the ventricles.

    b. They prevent blood flowing between the atria.

    c. They prevent blood flowing from the ventricles into the atria.

    d. They prevent blood flowing from the arteries into the ventricles.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 1

1. a. 6
   b. 3
   c. 8
   d. (1) given
   e. 10
   f. 5
   g. 2
   h. 11
   i. 7
   j. 9
   k. (13) given
   l. 4
   m. 12 (para 1-4)

2. b (para 1-3a(1)(a))

3. a (paras 1-1d, e)

4. d (para 1-2)

5. d (para 1-3a(2))

6. a (para 1-5h)

7. a (para 1-3c(2))

8. b (para 1-6)

9. d (para 1-5)

10. c (paras 1-4b, e)

End of Lesson 1

LESSON ASSIGNMENT

LESSON 2	Heart Attack and Cardiopulmonary Resuscitation.
TEXT ASSIGNMENT	Paragraphs 2-1 through 2-9.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

2-1. Define clinical death, biological death, heart attack, cardiac arrest, and cardiopulmonary resuscitation.

2-2. Identify factors that increase a person's risk of having a heart attack.

2-3. Identify signs and symptoms of a heart attack.

2-4. Identify how cardiopulmonary resuscitation simulates normal breathing and heartbeat.

2-5. Identify the recovery rates for cardiopulmonary resuscitation.

SUGGESTION After you have completed the text assignment, work the exercises at the end of this lesson before beginning the next lesson. These exercises will help you to achieve the lesson objectives.

LESSON 2

HEART ATTACK AND CARDIOPULMONARY RESUSCIATION

2-1. DEFINITIONS

a. **Heart Attack**. A heart attack (myocardial infarction) is the death of heart muscle tissue caused by a blood clot (thrombus) or other substance circulating in the blood (embolus) that blocks one or more of the coronary arteries (arteries that provide the heart muscles with oxygen-rich blood).

b. **Cardiac Arrest**. Cardiac arrest (sudden death) is the sudden and unexpected cessation of pulse and blood circulation. That is, the casualty's heart stops beating. When the heart stops beating, the casualty's breathing will also stop and he will loose consciousness, usually within 10 to 30 seconds of the cardiac arrest.

c. **Clinical Death**. Clinical death occurs as soon as the casualty's heart stops beating, he stops breathing, and he looses consciousness. Clinical death can be reversed by cardiopulmonary resuscitation (CPR).

d. **Biological Death**. Biological death usually occurs 6 to 10 minutes after clinical death if efforts to restore breathing and heartbeat are not performed. Biological death involves irreversible brain damage.

e. **Cardiopulmonary Resuscitation**. The prefix "cardio-" refers to heart, "pulmonary" refers to the lung, and "resuscitation" means to bring a person who appears to be dead back to consciousness. Thus, cardiopulmonary resuscitation means to restore lung function (breathing) and heart function (blood circulation) to a person who is clinically dead.

2-2. CAUSES OF CARDIAC ARREST

The primary cause of sudden death (cardiac arrest) is myocardial infarction (heart attack). Other causes of cardiac arrest include:

a. Drowning.

b. Electrical shock.

c. Poisoning

d. Suffocation.

e. Smoke inhalation.

f. Choking on food or other objects.

g. Anaphylactic shock (shock caused by hypersensitivity [severe allergic reaction] to a substance such as the venom from a bee sting).

h. Trauma (major injury).

i. Medical reasons (terminal illness, septic shock, sudden infant death syndrome, and so forth).

j. Hypovolemic shock (shock caused by severe blood loss).

k. Drug reaction.

2-3. PREDISPOSING FACTORS OF HEART ATTACK (RISK FACTORS)

Disease related to the heart and blood vessels are the greatest killers of people in this country. According to a 2005 American Heart Association study, sudden cardiac death from coronary heart disease occurs over 900 times per day in the United States. The risk in adults is estimated to be about 1 per 1,000 adults 35 years of age and older per year. Sudden cardiac death in the young (people less than 35 years old) is much less common than in older adults, occurring in only 0.5 to 1 per 100,000 per year. A review of published studies that report initial heart rhythms during cardiac arrest in children indicates that the majority (40 to 90 percent) of children have asystole (a-SIS'to-le) or pulseless electrical activity when first evaluated. However, ventricular fibrillation or ventricular tachycardia (ven-TRIK'u-ler tak"eh-KAR'de-ah) is found in about 7 to 14 percent of all children in cardiac arrest in the prehospital setting. About 60 to 70 percent of people who suffer myocardial infarction (MI) die before they reach a hospital. Most deaths from myocardial infarction occur within 2 hours following the heart attack. Death is usually caused by cardiac dysrhythmia (ventricular tachycardia), in which abnormal heart contractions prevent the normal circulation of blood. Some of the predisposing factors (those factors which make an incident more likely to occur) associated with heart attacks can be controlled. Controlling these factors makes a person less likely to have a heart attack.

a. **Major Risk Factors**. The four most important factors that predispose to heart attacks are listed below. All of these factors can be controlled.

(1) Cigarette smoking. A person who smokes more than one pack of cigarettes a day is twice as likely to have a heart attack than is a nonsmoker.

(2) Elevated (high) blood pressure. A person with a systolic pressure over 150 has more than twice the risk of heart attack (and four times the risk of stroke) than a person with a systolic pressure under 120. A diastolic pressure over 90 also increases the risk of heart attack.

(3) Elevated blood cholesterol. A person with a blood cholesterol level of 250 milligrams per deciliter (mg/dl) or higher has a greater risk of heart attack than does a person with normal blood cholesterol level.

(4) High fat, high cholesterol diet. A person who eats large amounts of foods that are high in fat and cholesterol runs a greater risk of heart attack than does a person who eats a normal diet.

b. **Other Risk Factors**. The following are also risk factors that, for the most part, are beyond the person's control.

(1) Age. Older persons are more likely to have heart attacks. About one-fourth of all heart attacks, however, occur in individuals under the age of 65.

(2) Sex. Males are more likely to have heart attacks than females.

(3) Diabetes. Diabetes increases the risk of heart attack; however, the risk may be lessened through medication and diet.

(4) Heredity. A person whose family has a history of cardiovascular disease is at greater than normal risk.

c. **Unproven Factors**. Some factors which are thought to make a heart attack more likely, but are not yet proven to do so, are:

(1) Obesity.

(2) Certain personality types.

(3) Stress.

(4) Lack of regular exercise (physical hypoactivity).

2-4. SIGNS AND SYMPTOMS OF A HEART ATTACK

A myocardial infarction can happen to either males or females, old or young, and not necessarily during physical or emotional stress. A person experiencing the early signs and symptoms of a heart attack may not know that he is having a heart attack. He may state that he feels like having "bad indigestion."

a. A heart attack may begin with pain, uncomfortable pressure, squeezing, fullness, or tightness around the chest. The pain is usually located in the center of the chest behind the breastbone (sternum). The pain may be substernal and may be described as crushing; many patients describe the pain as, “It feels like an elephant is sitting on my chest.” The pain may not be severe. Sharp, stabbing twinges of pain are usually not symptoms of a heart attack.

(1) The pain may spread to a shoulder, an arm, or neck.

(2) The duration of the pain is usually 2 minutes or longer. The pain may come and go.

b. The person may also feel weak, have shortness of breath, perspire, and be nauseous (feel like vomiting).

c. Signs and symptoms may come and go, depending upon factors such as the severity of damage to the casualty's heart and the casualty's physical activity during or immediately before the heart attack. The disappearance of symptoms may cause the casualty to deny that he has suffered a heart attack.

d. In some cases, the heart attack results in cardiac arrest (no pulse or heartbeat).

2-5. NEED FOR CARDIOPULMONARY RESUSCITATION

As stated previously, the blood supplies the cells of the body with oxygen. In a medical emergency, you must ensure that this supply of oxygen continues. The supply of oxygen to the body cells is threatened whenever the person stops breathing on his own or when the person's heart stops pumping blood. When the oxygen supply fails, cells begin to die. The length of time required for a cell to die after the oxygen supply has stopped depends upon several factors. One of the most important factors is the type of cell involved. Brain cells are the most sensitive. Permanent brain damage usually occurs if the oxygen supply is stopped for more than 6 minutes. Therefore, a casualty who has suffered a cardiac arrest must have breathing and circulation restored quickly if biological death is to be prevented. The process of restoring breathing is called rescue breathing. Artificial heartbeats are produced by administering chest compressions. In neither case, however, is the substitute measure as efficient as the body's natural process.

2-6. EFFECTS OF RESCUE BREATHING

Rescue breathing consists of two phases. In the first phase, the rescuer blows a breath into the casualty's lung. This replaces the casualty's normal inhalation. Once the inhalation phase is completed, the rescuer breaks his seal over the casualty's airway. This allows the casualty's body to exhale on its own.

a. **Inhalation Phase**. Once the rescuer seals the casualty's airway so that air cannot escape, he blows air into the casualty's airway (usually though the casualty's mouth). The pressure from the rescuer's breath forces air through the rest of the respiratory tract and causes the alveoli to expand. This causes in the lungs as a whole to expand. When the lungs expand, they cause the rib cage (chest) to rise and the diaphragm to flatten somewhat.

b. **Exhalation Phase**. When the rescuer removes his mouth from the casualty (breaks the seal over the casualty's airway), the higher air pressure in the casualty's respiratory system causes air to rush from the airway and into the atmosphere. The rib cage and the diaphragm resume their normal positions (the chest falls and the diaphragm pushes into the chest cavity by resuming its dome-like shape). These actions result in air being forced out of the lungs, just as in normal exhalation.

2-7. EFFECTS OF CHEST COMPRESSIONS

a. The heart is located between the sternum and the spine. If the sternum is pressed down (depressed) far enough into the chest cavity (1 1/2 to 2 inches in an adult), the heart is compressed between the sternum and the spine (figure 2-1A). Blood is then forced out of the ventricles and into the arteries.

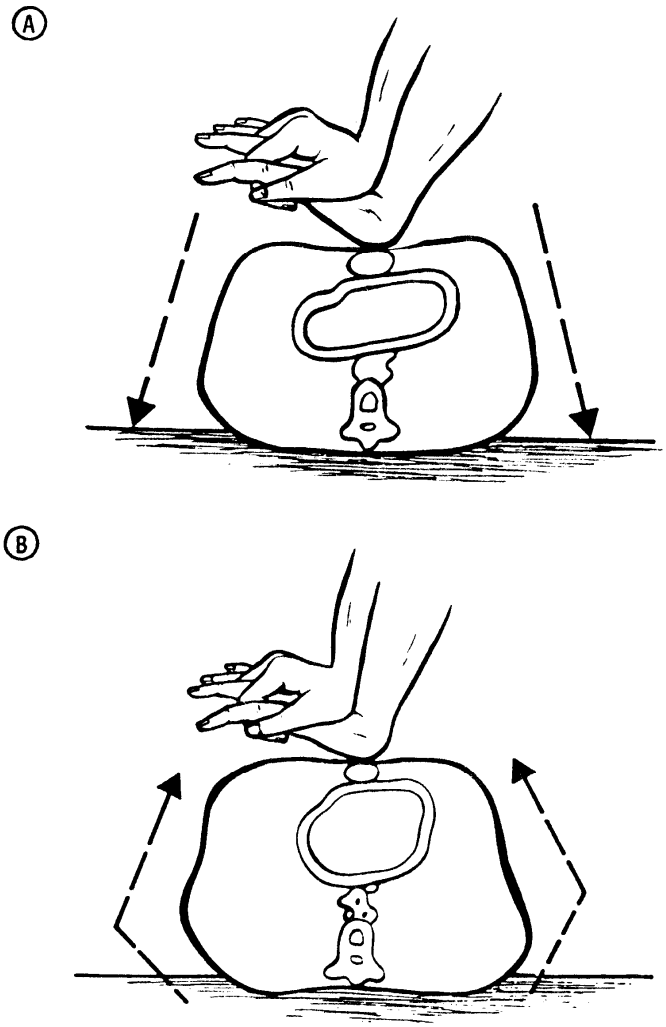


Figure 2-1. Effects of chest compression. A Compression. B Release.

b. When the pressure is removed from the sternum, it rises to its normal position and the heart resumes its normal shape (figure 2-1B). Since blood was forced out of the ventricles during the compression, blood flows from the atria into the ventricles, as the heart returns to its normal shape. As blood flows out from the atria into the ventricles, blood also flows from the veins to refill the atria.

c. Each pressure-release cycle is roughly equal to one heartbeat.

2-8. ROLE OF THE RESCUER

In order to properly treat a casualty requiring CPR, the rescuer must take the following actions. These actions are summarized in figure 2-2.

a. **Early Access**. The rescuer, whether trained or untrained, must activate the emergency medical service (EMS) system early, even before beginning CPR.

b. **Early CARDIOPULMONARY RESUSCITATION**. The brain and other body tissues cannot tolerate long term hypoxia (low state of oxygen in the blood). Because of this, CPR must be started as soon as possible to increase the chance of patient survival. High-quality bystander CPR can double or triple survival rates from cardiac arrest. Less than one-third of victims of sudden cardiac arrest (SCA) receive bystander CPR, and even fewer receive “high-quality” CPR.

c. **Early Defibrillation**. Treatment of ventricular fibrillation (VF) in SCA requires early CPR and shock delivery with a defibrillator. Lay rescuer and first responder CPR and automated external defibrilator (AED) programs in airports and casinos and with police officers have reported survival rates from witnessed VF SCA as high as 49 to 74 percent.

d. **Early Advanced Care**. Early Advanced Cardiac Life Support (ACLS) procedures should be performed.

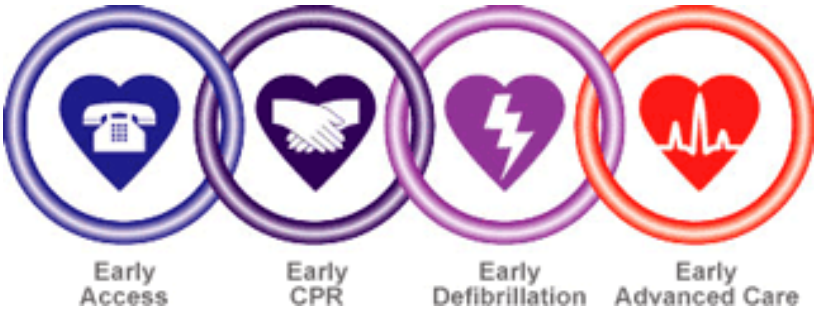


Figure 2-2. The CPR Chain of survival (adult).

2-9. RECOVERY RATES

Experience with situations requiring basic life support (BLS) has demonstrated that a significant number of casualties suffering cardiac arrest can be successfully resuscitated if CPR is provided promptly and followed by more advanced cardiac life support. Prompt response is critical.

a. Early CPR and defibrillation within the first 3 to 5 minutes after collapse, plus early advanced care can result in high (greater than 50 percent) long-term survival rates for witnessed ventricular fibrillation.

b. The value of early CPR by bystanders is that it can "buy time" by maintaining some blood flow to the heart and brain during cardiac arrest. Early bystander CPR is less helpful if EMS personnel equipped with a defibrillator arrive later than 8 to 12 minutes after the collapse.

Continue with Exercises

EXERCISES, LESSON 2

INSTRUCTIONS: Circle the letter of the response that BEST completes the statement or BEST answers the question. After you have completed all of the exercises, turn to "Solutions to Exercise" at the end of the lesson exercises and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. Cardiopulmonary resuscitation consists of:

   a. Artificially restoring blood circulation through the use of chest compressions.

   b. Artificially restoring breathing through the use of rescue breathing procedures.

   c. Both a and b above.

2. Which one of the following terms is used to describe the death of heart tissue due to the blockage of a coronary artery?

   a. Biological death.

   b. Cardiac arrest.

   c. Clinical death.

   d. Heart attack.

3. Which of the following signs and symptoms is <u>least likely</u> to occur when a casualty has a heart attack?

   a. Nausea.

   b. Sharp, stabbing chest pains.

   c. Shortness of breath.

   d. Uncomfortable feeling of pressure behind the sternum.

4. The most common cause of cardiac arrest is:

   a. Drug reaction.

   b. Electrical shock.

   c. Heart attack.

5. Biological death usually results if a person's heart stops beating (normal pumping action stops and CPR is not administered) for:

   a. 30 seconds.

   b. 1 minute.

   c. 3 minutes.

   d. 6 minutes.

6. Chest compressions simulate normal heart function by:

   a. Forcing blood to be pumped by squeezing the heart between the sternum and the spine.

   b. Causing an artificial electrical stimulation which causes the ventricles of the heart to contract.

   c. Forcing blood to be pumped by the atria into the veins instead of the ventricles pumping blood into the arteries.

   d. Causing the diaphragm to rise and fall, thus producing a pulse.

7. Of the following, which is most likely to result in a person having a heart attack?

   a. Being a female.

   b. Having a family history of cardiovascular disease.

   c. Having high blood pressure.

   d. Not having a program of regular exercise.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 2

1. c (paras 2-1e, 2-6, 2-7)
2. d (para 2-1a)
3. b (paras 2-4a, b)
4. c (para 2-2)
5. d (paras 2-1d, 2-5)
6. a (para 2-7)
7. c (para 2-3a(2))

End of Lesson 2

LESSON ASSIGNMENT

LESSON 3	Initiate Rescue Breathing on an Adult.
TEXT ASSIGNMENT	Paragraphs 3-1 through 3-12.
TASK TAUGHT	081-831-0018, Open the Airway. 081-831-0048, Perform Rescue Breathing.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

3-1. Identify the steps (in sequence) for evaluating a casualty and initiating rescue breathing.

3-2. Identify the proper procedures (in sequence) for opening a casualty's airway using the jaw-thrust method and the head-tilt/chin-lift method.

3-3. Identify the proper procedures (in sequence) for administering mouth-to-mouth, mouth-to-nose, and mouth-to-stoma rescue breathing.

3-4. Identify the proper procedures for taking a carotid pulse.

SUGGESTION After you have completed the text assignment, work the exercises at the end of this lesson before beginning the next lesson. These exercises will help you to achieve the lesson objectives.

LESSON 3

INITIATE RESCUE BREATHING ON AN ADULT

3-1. REMOVE CASUALTY FROM ANY IMMEDIATE DANGER

If you see a possible casualty, you must evaluate the person to determine if rescue breathing should be initiated. Before you begin the evaluation procedure, however, evaluate your surroundings to determine the appropriate care for those surroundings. If you are in the "care under fire" phase of care, then opening the airway and controlling bleeding are your primary concerns; rescue breathing will not be initiated at this time. If other danger exists in the non-tactical environment, the hazards must be assessed for threat to life. If a major life threat exists, then moving the patient prior to further evaluation and treatment would be necessary. Cardiopulmonary resuscitation is not considered an appropriate treatment under most battlefield conditions because most of these patients will be traumatized in manner that would not support life without immediate and extensive surgery.

NOTE: The steps for evaluating a casualty and initiating rescue breathing are the same as for initiating cardiopulmonary resuscitation. These are also the same steps normally used to evaluate any casualty.

3-2. CHECK FOR RESPONSIVENESS

Establish responsiveness by using the AVPU system. Check to see if the patient is alert (A), responsive to verbal commands (V), responds to pain (P), or is unresponsive (U). Establishing responsiveness will usually take between 4 to 10 seconds.

CAUTION: If the casualty was injured in a motor vehicle accident, in a parachuting accident, in a diving accident, by a fall, by a blow to the back, or by some other violent incident that could result in injury to the back, take proper spinal precautions in treating the casualty. Be careful not to violently shake or move any patient. This will help to prevent aggravation of any injuries that may be present.

a. If the casualty answers, he is conscious and breathing, continue your examination of the casualty and render whatever aid is needed. (Evaluation and treatment procedures for injuries are presented in other 91W10 subcourses.)

b. If the casualty does not respond, he is unconscious. Perform the evaluation and treatment procedures given in the following paragraphs.

3-3. CALL FOR HELP

If the casualty does not respond (unconscious), attempt to obtain additional medical help. Do not leave the casualty to obtain help.

a. If you are alone with the casualty, shout for help. In the tactical setting, this would not be practical and other methods of signaling should be considered.

b. If another person is available, and if a radio or telephone is available, have the person use the radio or telephone to summon medical help. If you are alone, use the radio or telephone to call for help and return to the casualty and begin medical help.

c. If someone who is not medically trained is available, send him to get additional medical help.

d. If you are in a hospital and find an unconscious patient, summon help using available systems. These systems may include bells, lights, verbal calls for assistance, codes to alert medical personnel, and intercoms.

3-4. CHECK FOR SPINAL INJURY

Check the casualty for a spinal injury. If the casualty has a spinal injury, minimize any additional movement of the casualty (using the jaw-thrust method of opening the airway rather than the head-tilt/chin-lift method, for example). Moving a casualty with a fractured spine may cause additional damage to the spinal cord, which could result in paralysis or even death. If you suspect a spinal injury, perform your efforts as though you knew that a fracture of the spine were present. Do not try to straighten a fractured spine. Signs of spinal injury include:

a. Bruises and/or swelling over the spinal area.

b. Casualty lying in an abnormal (deformed) position.

c. Fluid draining from one or both ears.

3-5. POSITION THE CASUALTY

Position the casualty flat on his back and on a hard surface. Rescue breathing is most effective when the casualty is lying on his back. Chest compressions (part of CPR) are not effective unless the casualty is lying on his back and lying on a hard surface.

a. If the casualty is lying on a bed or cot, remove the casualty from the bed or cot and place him on the floor or ground. An alternative is to place a bed board or long backboard between the casualty's back and the bed or cot.

b. If the casualty is lying on the ground in a supine (on his back) position, place his arms at his side and proceed to establish an open airway.

c. If the casualty is lying on solid ground in a prone (on his chest) position, turn him onto his back using the procedures given below. These procedures allow the casualty to be turned as a unit. Turning the casualty as a unit minimizes the likelihood that existing injuries will be aggravated, and also minimizes the chances that the head or neck will be injured during the turning. It is especially important to use these procedures if you suspect that the casualty has a spinal injury.

(1) Straighten the casualty's legs.

(2) Kneel beside the casualty. Your knees should be near his chest area, but there should be enough space between you and the casualty for you to roll him onto his back.

(3) Take one of the casualty's arms and move it so that the arm is straight and above his head. Then move his other arm so that it is also straight and above his head.

(4) Support the casualty's head and neck by placing your hand that is nearest his head on the back of his head (figure 3-1A).

(5) With your other hand, reach across the casualty's back and grasp the casualty's uniform under his far arm.

(6) Pull on the casualty's uniform and roll the casualty toward you (figure 3-1B). Use a steady and even pull so that the casualty's head and neck stay in line with his back. (If you have a person to assist you, have the person to help roll the casualty's hips and legs.)

(7) Once the casualty is lying flat on his back, return the casualty's arms to his side (figure 3-1C). If his legs are crossed, uncross them.

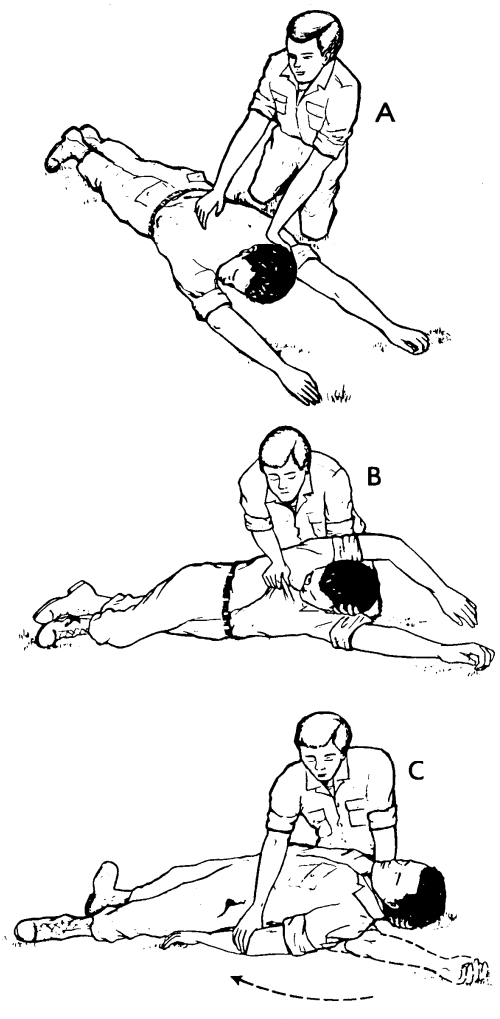


Figure 3-1. Rolling a casualty onto his back.

3-6. OPEN THE AIRWAY

Once the casualty is in position for rescue breathing, open the casualty's airway using either the head-tilt/chin-lift method or the jaw thrust method. Sometimes an unconscious casualty who is not breathing or breathing in a weak manner will resume normal respiration when his head is positioned correctly and his airway is opened. This is especially true if the casualty's tongue is blocking the airway. The tongue is the most common cause of airway obstruction in unconscious casualties. Repositioning (lifting) the lower jaw forward lifts the tongue away from the back of the throat and unblocks the airway. Establishing an airway should take between 3 and 5 seconds.

NOTE: An unconscious casualty does not "swallow his tongue." The muscles of the tongue simply relax and slide to a lower position which results in the pharynx being blocked.)

a. **Head-Tilt/Chin-Lift Method.** The head-tilt/chin-lift (figure 3-2) is the preferred method of opening the casualty's airway if a neck fracture is not suspected. In addition, loose dentures can be handled easier using the head-tilt/chin-lift method.

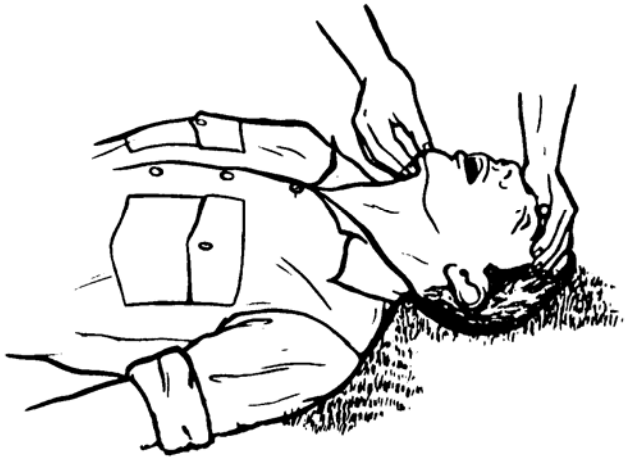


Figure 3-2. Opening the airway: head-tilt/chin-lift method.

(1) Kneel at the side of the casualty's head or shoulders.

(2) Place your hand (the hand closest to the casualty's head) on his forehead.

(3) Apply firm, backward pressure with the palm of your hand. This pressure will cause the casualty's head to tilt back.

(4) Place the fingertips of your other hand under the bony part of his chin, not on the soft flesh under his chin. Pressing on the soft flesh under the chin could result in blocking his airway.

(5) Lift his chin with your fingertips. Continue to lift the lower jaw until his upper and lower teeth are <u>almost</u> brought together. The mouth should <u>not</u> be closed as this could prevent air from entering the casualty's airway.

b. **Jaw-thrust Method**. The jaw-thrust (figure 3-3) is the preferred method of establishing an airway if you suspect that the casualty has a fractured neck. The jaw-thrust method moves the casualty's tongue forward (away from the airway) without extending his neck.

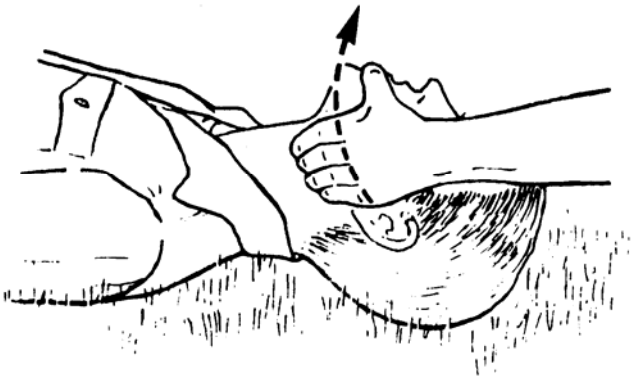


Figure 3-3. Opening the airway: jaw-thrust method.

(1) Kneel behind the casualty's head.

(2) Rest your elbows on the surface on which the casualty is lying.

(3) Place one hand on each side of the casualty's head.

(4) Place the tips of your index and middle fingers under the angles of the casualty's jaw. (This is done on both sides of the casualty's jaw.)

(5) Place your thumbs on the casualty's jaw just below the level of the teeth. The thumbs will keep the casualty's head from turning or tilting during the lift.

(6) Lift the jaw upward with your fingertips. The mouth should not be closed as this could prevent air from entering the casualty's airway. Use your thumb to retract the casualty's lower lip if needed.

(7) If the lift does not open his airway (tongue is still blocking the airway), lift the jaw up a little further. If this is unsuccessful, tilt the casualty's head backward very slightly. In accordance with (IAW) American Heart Association (AHA) guidelines 2005, if you are unable to obtain an airway with the jaw-thrust method, the head-tilt/chin-lift method should be used. The importance of maintaining a patent airway outweighs the risk of spinal damage.

3-7. CHECK FOR BREATHING

Check to see if the casualty is breathing adequately (figure 3-4). Many times, opening the airway is all that is necessary to restore breathing in an unconscious casualty. This check usually takes 3 to 5 seconds to perform. Keep maintaining the casualty's airway (head-tilt/chin-lift or jaw-thrust) while you perform the check.

NOTE: This is the first time that you actually check to see if the casualty is breathing adequately. Even if an unconscious casualty is breathing when you find him, his breathing could deteriorate or stop altogether while you are performing other measures if you do not take the precaution of positioning him so that his airway stays open.

a. Place your ear over the casualty's mouth and nose and look towards the casualty's chest. For the best results, your ear should be almost touching the casualty.

b. Look at the casualty's chest. If the casualty is breathing, you should be able to see the chest rise and fall.

c. Listen for the sound of breathing (air being inhaled and exhaled).

d. Feel for the flow of air on the side of your face caused by the casualty exhaling

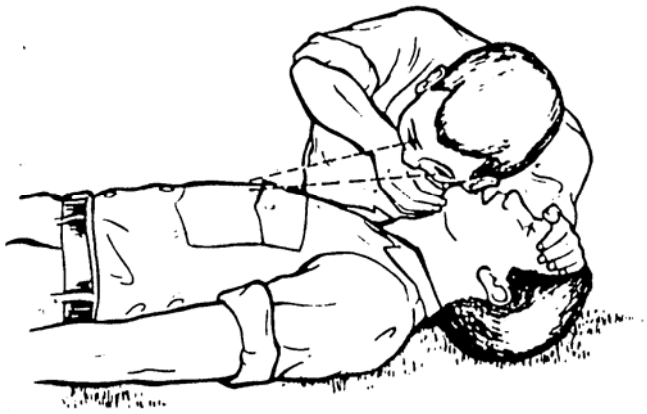


Figure 3-4. Check for breathing using the head-tilt/chin-lift.

3-8. EVALUATE YOUR FINDINGS

a. If your check shows that the casualty is not breathing, try to open his airway again and check for breathing a second time. If he is still not breathing, begin administering ventilations immediately (paragraph 3-9).

b. If your check shows that the casualty is breathing, asses the rate and quality of breathing. Just because a casualty is breathing does not ensure that the depth of breathing or the rate are adequate to support life. (If the casualty is breathing 4 times per minute, he is technically breathing; but this rate is not adequate to sustain the casualty's life). If the casualty has adequate breathing, consider inserting an airway adjunct to help control and protect the casualty's airway. If available, oxygen should be administered at this time. Continue to examine the casualty for injuries while maintaining his airway. Check on his breathing periodically. Reopen the airway and perform rescue breathing should the casualty stop breathing.

(1) If the casualty regains consciousness, place him in the left lateral recumbent position (figure 3-5) if no other injuries are present.

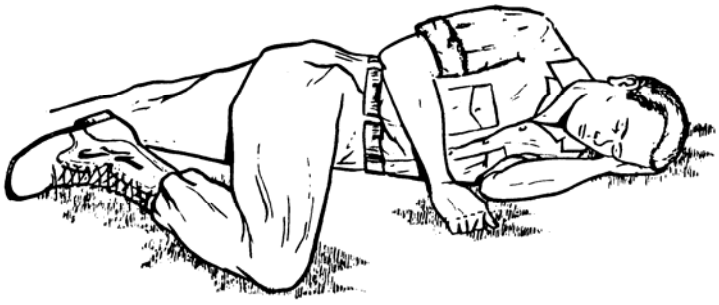


Figure 3-5. Unconscious casualty in the left lateral recumbent position.

(2) If the casualty is unconscious and you have an oropharyngeal airway (OPA or J-tube) available, you can insert the airway to prevent the casualty's airway from being blocked by his tongue. Remove the airway when the casualty begins to regain consciousness.

(a) Make sure that you insert the correct size of airway. Place the oropharyngeal airway along the outside of the casualty's jaw. The airway should reach from the bottom tip of his ear to the corner of his mouth.

(b) Open the casualty's mouth. If you have difficulty in opening his mouth, place your crossed thumb and index finger on the casualty's upper and lower teeth near a corner of his mouth and push until his teeth separate and his mouth opens.

(c) Place the tip end (not the flanged end) of the oropharyngeal airway into the casualty's mouth so that the tip points toward the roof of the casualty's mouth.

(d) Slide the airway along the natural curvature of the tongue.

(e) When the tip of the airway reaches the back of the tongue past the soft palate, rotate the airway 180 degrees so the tip of the airway points down toward his throat.

(f) Advance the airway until the flange rests on the casualty's lips.

(3) If the casualty has an intact gag reflex but can still not protect his airway, insert a nasopharyngeal airway.

(a) Ensure the airway is the correct size by measuring the diameter of the airway with the patient's fifth finger (pinky) and the correct length by measuring the airway from the corner of the patient's nostril to the tip of the ear.

(b) Lubricate the airway.

(c) Insert the airway in to the patient's right nostril with the bevel towards the septum. This is anatomically the larger nostril in most people, and the curve of the airway is designed to be inserted in this side. Insert the airway by pushing it towards the back of the patient's head until the flange rests on the casualty's nare.

3-9. ADMINISTER TWO BREATHS

If the unconscious casualty is not breathing, you will need to perform rescue breathing. Rescue breathing procedures are also called "ventilating the casualty." Ventilation simply means that you are supplying the casualty's lungs with fresh air. Even though the air comes from your lungs, it still contains plenty of oxygen. Room air contains about 20 percent oxygen; we use about 4 percent of this leaving 16 percent oxygen available to the patient when mouth-to-mouth rescue breathing is conducted. The mouth-to-mouth technique of rescue breathing is normally used. An alternate technique, the mouth-to-nose method, is used when the casualty has a serious mouth or jaw injury, when the casualty's mouth cannot be opened, or when you are unable to achieve a tight seal around the casualty's mouth. Check for the presence of a stoma (an artificially-created opening in the neck and trachea). A stoma allows air exchange when the casualty's upper airway is blocked due to surgery or a medical condition such as cancer. If a stoma is present, perform mouth-to-stoma rescue breathing. Cover the patient's mouth and nose when conducting mouth-to-stoma breathing to make sure the air does not escape through this route instead of entering the lungs. As you administer the two ventilations, observe the casualty's chest out of the corner of your eye to see if the chest rises and falls. It should take about one second to blow a breath into the casualty's lungs. Allow time between breaths for the chest to fall and the casualty to exhale. Avoid over inflation of the lungs, which can cause complications, including gastric distention, and can also increase the intra-thoracic pressure, making it difficult for blood to return to the fill the heart.

a. **Mouth-to-Mouth**. Mouth-to-mouth rescue breathing (figure 3-6) is also called mouth-to-mouth resuscitation. The following steps assume that you are maintaining the airway using the head-tilt/chin-lift method.

Figure 3-6. Administering mouth-to-mouth rescue breathing.

(1) Maintain airway. Keep the casualty's airway open (patent) by maintaining the head-tilt/chin-lift.

(2) Inhale. Take a deep breath.

(3) Pinch the nose. Use the thumb and index finger of your hand that is on the casualty's forehead to pinch his nostrils closed so that air will not escape when you blow air into his mouth. Keep the heel of your hand on the casualty's forehead and continue to apply enough pressure to maintain the head tilt. The fingertips of your other hand remain under the casualty's chin and continue to keep the chin lifted.

(4) Seal the mouth. Place your mouth over the casualty's mouth. Cover his mouth completely and make sure that your mouth forms an airtight seal so that air will not escape when you blow air into his mouth.

(5) Deliver the first breath. Blow a breath at a slow rate into the casualty's mouth. (Maintaining the open airway will keep the casualty's mouth slightly open.) If the airway is truly open, the chest should rise as his lungs fill with air.

(6) Take another deep breath. After blowing into the casualty's mouth, quickly break the seal over his mouth, take a breath of air, exhale, and then take another deep breath. The casualty's chest should fall as air escapes from his mouth after you break the seal. You may be able to hear or feel the exhaled breath also.

(7) Seal the mouth. Seal your mouth over the casualty's mouth again so that air will not escape.

(8) Deliver the second breath. Blow another breath into the casualty's mouth at a slow rate. Observe the casualty's chest.

(9) Break the seal and release nose. After delivering the second breath, break the seal over the casualty's mouth and release the nose. The casualty's body will exhale without further effort on your part.

b. **Mouth-to-Nose**. The mouth-to-nose rescue breathing (figure 3-7) is also called mouth-to-nose resuscitation.

Figure 3-7. Administering mouth-to-nose breathing.

(1) Maintain airway. Keep the casualty's airway open by keeping the chin lifted.

(2) Inhale. Take a deep breath.

(3) Close the mouth. Use the hand that is lifting the casualty's jaw to close the casualty's mouth. No air should escape through the casualty's mouth when you perform your ventilations. Continue to keep the jaw in a "lifted" position. (If the head-tilt/chin-lift is being used, maintain the pressure on the forehead with your other hand to keep the casualty's airway open.)

(4) Seal the nose. Place your mouth over the casualty's nose. Make sure that your mouth forms a seal so that air will not escape when you blow air into his nose.

(5) Deliver the first breath. Blow a breath into the casualty's nose at a slow rate. If the airway is open, the chest will rise as his lungs fill with air.

(6) Take another breath. After blowing into the casualty's nose, quickly break the seal over his nose, take a breath of air, exhale, and take another deep breath. His chest should fall somewhat as air escapes from the casualty's nose after you break the seal. You may be able to hear or feel the exhaled breath also.

(7) Seal the nose. Seal your mouth over the casualty's nose again so that air will not escape.

(8) Deliver the second breath. Blow another breath into the casualty's nose at a slow rate and observe the casualty's chest.

(9) Break the seal and open mouth. After delivering the second breath, break the seal over the casualty's nose and allow his mouth to open slightly while continuing to maintain the open airway. (The mouth is opened in case there is an obstruction in the casualty's nasal passages.) The casualty's body will exhale naturally without effort on your part. If the mouth does not open readily, use your thumb to depress the lower lips slightly to separate the lips.

c. **Mouth-to-Stoma**. The mouth to stoma rescue breathing is used if a permanent or temporary opening has been made at the front base of the neck in order to open the airway to the atmosphere.

(1) Inhale. Take a breath.

(2) Close the mouth and nose, if needed. Use a hand to close the casualty's mouth and nostrils in order to prevent air escaping.

(a) This step is not needed if the casualty's upper airway has been closed surgically, as shown in figure 3-8.

Figure 3-8. Administering mouth-to-stoma rescue breathing.

(b) If the casualty has a temporary tracheostomy tube in the trachea, the tube may have a cuff that can be inflated to seal off the airway above the stoma and thus prevent air from escaping through the mouth or nose.

(3) Seal the stoma. Place your mouth over the casualty's stoma. Make sure that your mouth forms an airtight seal so that air will not escape when you blow air into the stoma.

(4) Deliver the first breath. Blow a breath into the stoma. His chest should rise as his lungs fill with air.

(5) Take another breath. After delivering the first breath, quickly break the seal over the stoma, take a breath of air, exhale, and then take another breath. His chest should fall somewhat as air escapes from the stoma after you break the seal. You may be able to hear or feel the exhaled air also.

(6) Seal the stoma. Seal your mouth over the stoma again so that air will not escape.

(7) Deliver the second breath. Blow another breath at a slow rate into the stoma and observe the casualty's chest.

(8) Break seal. After delivering the second breath, break the seal over the stoma. If you are holding the casualty's mouth and nose closed, you can release them. The casualty's body will exhale naturally.

3-10. EVALUATE THE EFFECTIVENESS OF THE TWO VENTILATIONS

a. **Spontaneous Breathing Resumes.** If the casualty begins breathing again on his own, check his circulation and continue your assessment. Do not leave the casualty since his breathing may stop again. The casualty may still require help to keep his airway open.

b. **Airway Blocked.** If the casualty's chest did not rise and fall, then fresh air is not getting into his lungs. Reposition the casualty's airway in an attempt to open the airway. Then administer two breaths again using the same procedures. If the casualty's chest still does not rise, he probably has an object blocking his airway. Remove the obstruction using finger sweeps and manual thrusts as described in paragraph 5-6. Once the obstruction has been removed, administer two full breaths and proceed to check the casualty's pulse (paragraph 3-11).

c. **Airway Open with No Spontaneous Breathing.** If air goes in and out of the casualty's lungs (airway open) but he does not start breathing on his own, check his pulse (paragraph 3-11) and determine if chest compressions are required.

3-11. CHECK CAROTID PULSE

Check the casualty's pulse after you have successfully administered the two initial ventilations. Getting fresh air into the casualty's lungs will not help if his heart is not beating and the blood is not circulating. There are two major arteries, called the carotid arteries, in the neck. One artery lies in a grove on the left side of the trachea (windpipe); the other lies in a groove on the right side of the trachea. Either artery may be used to check the casualty's carotid pulse, but you will normally use the artery on the side of the neck closest to you. The carotid pulse is used because you are already near the neck, it is easily accessible, and a pulse can sometimes be felt at the carotid artery when the pulse may be too weak to be detected at arteries farther from the heart. It is also typical to check the radial pulse at the same time as the carotid pulse.

a. **Locate Pulse Site**. Place the index and middle fingers of your hand on the casualty's trachea or larynx. Then slide your fingers toward you while gently pressing on the neck until you find the groove running parallel to the airway (figure 3-9).

(1) If you are using the chin-lift/head-tilt, remove your hand from the casualty's chin and use that hand to locate the pulse site. Keep your other hand on his forehead and maintain the head-tilt.

(2) If you are using the jaw-thrust, use your dominant hand to check for a pulse while maintaining the casualty's airway with the other hand.

(3) Three fingers (index, middle, and ring fingers) can be used instead of only two fingers.

CAUTION: Do not use your thumb. The thumb has a detectable pulse and you may mistake the pulse in your thumb for the casualty's pulse.

b. **Feel for Pulse**. Press gently on the carotid artery with your fingertips. Allow enough time to detect a pulse that is weak, slow, and/or irregular. The check should take between 5 and 10 seconds.

Figure 3-9. Locating the carotid pulse.

c. **Evaluate the Pulse Check**.

(1) If no pulse can be felt, cardiopulmonary resuscitation is required immediately. The procedures for administering cardiopulmonary resuscitation are given in Lesson 4.

(2) If a pulse can be felt, determine the rate and quality of the pulse. Ensure that the pulse is adequate to sustain life. (A pulse of less than 40 beats per minute [BPM] is not adequate to sustain life in most adults and CPR should be started.) Administer the rescue breathing procedures given in paragraph 3-12.

3-12. CONTINUE RESCUE BREATHING

If the casualty's heart is beating adequately and he is not breathing on his own, continue to administer rescue breathing. Administer ventilations (breaths) at the rate of 1 ventilation about every 5 seconds (10 to 12 ventilations per minute). Keep the casualty's airway open, while performing the ventilations and continue to monitor the casualty's pulse.

a. **Perform Ventilations.** Administer ventilations using the mouth-to-mouth, the mouth-to-nose, or the mouth-to-stoma method, as appropriate. Ventilations can also be provided with the bag-valve-mask or other equipment that is discussed in other subcourses. The steps given below assume that the mouth-to-mouth method is being used with the head-tilt/chin-lift. Adjust the procedures as needed if another combination is being used.

(1) Take a breath.

(2) Pinch the casualty's nostrils closed using the thumb and index finger of the hand on his forehead.

(3) Place your mouth over the casualty's mouth, making sure that a tight seal is formed.

(4) Blow into the casualty's mouth at a slow rate. As you blow, observe his chest. If his chest does not rise, a sufficient amount of air is not getting into his lungs. This may be caused by an inadequate positioning of his airway, by air leaking from the casualty's nose, by air leaking from around your mouth, or by the breath not being delivered with sufficient force. If a problem exists, correct the problem and continue administering ventilations.

(5) Remove your mouth from around the casualty's mouth and release his nose. This allows him to exhale. Remember, the casualty's airway must be kept open so he can exhale.

(6) Inhale and exhale a small breath for yourself if you need to do so.

(7) Repeat the above procedures at a rate of one ventilation every 5 seconds until you have completed 10 to 12 ventilations.

b. **Recheck Pulse.** Recheck the casualty's carotid pulse after every 10 to 12 breaths (about every minute). As you check his pulse, also look, listen, and feel for signs that the casualty has begun to breathe on his own.

(1) If the pulse is absent, begin administering chest compressions (Lesson 4).

(2) If the casualty begins breathing on his own, maintain his airway and check for other injuries. If the casualty remains unconscious, an oropharyngeal airway may be inserted. Monitor the casualty's respirations in case he stops breathing again. The casualty will need to be evacuated for further evaluation and treatment by a physician.

(3) If the casualty still has a pulse but is not breathing on his own, continue to administer rescue breathing and recheck the pulse, after every 12 ventilations. Continue until the casualty begins breathing on his own, you are relieved by another qualified person, you are ordered to stop, or until you are too exhausted to continue.

NOTE: In a hospital, only a physician can order that resuscitation efforts be stopped.

Continue with Exercises

EXERCISES, LESSON 3

INSTRUCTIONS: Circle the letter of the response that BEST completes the statement or BEST answers the question. After you have completed all of the exercises, turn to "Solutions to Exercises" at the end of the lesson exercises and check your answers. For each exercise answered incorrectly, reread the material referenced after the solution.

1. You are near a car wreck. A car is on fire and a person is still in the car. As a rescuer, which of the following should be your first action?

   a. Gently shake the person and shout, "Are you O.K.?"

   b. Remove the casualty from the burning vehicle.

   c. Open the casualty's airway.

   d. Check for a pulse.

2. Before beginning rescue breathing on a casualty, you should check the casualty for the presence of a fractured:

   a. Arm.

   b. Leg.

   c. Rib.

   d. Spine.

3. You find a person in a park lying on the ground and not moving. As a rescuer, which of the following should you perform first?

   a. Administer five chest compressions.

   b. Administer two breaths.

   c. Gently shake the person and shout, "Are you O.K.?"

   d. Open the person's airway.

4. You are treating a casualty who requires CPR. There is no one to assist you. Should you delay starting CPR in order to telephone for help?

   a. Yes

   b. No.

5. You are preparing to administer rescue breathing to a soldier lying on his stomach. What should you do to the casualty before administering ventilations?

   a. Kneel beside the casualty, grasp the casualty's uniform under his arm, push on the uniform, and roll the casualty away from you.

   b. Kneel beside the casualty, reach across the casualty's back and grasp the casualty's uniform under his arm, pull on the uniform, and roll the casualty toward you.

   c. Stand over the casualty so that you straddle the casualty's hips, bend over and grasp the casualty's uniform under each armpit, lift the casualty's upper body, twist the casualty so that his chest is down, and lower the casualty.

   d. Nothing.

6. How is the head-tilt portion of the head-tilt/chin-lift method of opening an adult casualty's airway accomplished?

   a. Place the palm of your hand on his forehead and press his head back.

   b. Place your fist on his forehead and press his forehead back.

   c. Place the palm of your hand under the back of his head and lift his head forward.

   d. Place your fist under the back of his head and lift his head forward.

7. In the jaw-thrust method of opening an adult casualty's airway, the jaw is lifted by:

    a. Placing the fingertips under the angles of the jaw and lifting while using your thumbs to keep the chin steady.

    b. Hooking the thumb under the casualty's jaw, then lifting the chin.

    c. Placing the fingertips under the bony part of the chin, hooking the thumb over the casualty's bottom teeth, then lifting the chin.

    d. Pressing the thumbs tightly on each side of the chin and pushing down.

8. After you have performed the head-tilt/chin-lift, the casualty's mouth should be:

    a. Closed.

    b. Almost closed.

    c. As wide open as possible.

9. You have found an unconscious casualty and are initiating rescue breathing. When is the first time that you really take time to see if the casualty is breathing?

    a. Just before you check the casualty for responsiveness.

    b. Immediately after you check the casualty for responsiveness.

    c. Just before you open the casualty's airway.

    d. Immediately after you open the casualty's airway.

10. After using the head-tilt/chin-lift method to open a casualty's airway, the casualty began to breathe normally and soon regained consciousness. The casualty has no injuries. How should you position the casualty?

    a. On his side.

    b. On his back.

    c. On his chest.

11. You are checking a casualty for spontaneous breathing. Which of the following statements is/are true concerning the look, listen, and feel procedures?

    a. You are looking at the casualty's face.

    b. You are listening for the casualty's heartbeat.

    c. You are feeling for the casualty's carotid pulse.

    d. None of the above are correct.

12. You have found an unconscious casualty who is not breathing. After opening his airway, you should:

    a. Administer two full ventilations.

    b. Administer three full ventilations.

    c. Administer four full ventilations.

13. You are administering rescue breathing using the mouth-to-mouth method. What, if anything, is done to the casualty's nose?

    a. The rescuer uses the thumb and finger of his hand on the casualty's chin to pinch the nostrils closed before he blows into the casualty's mouth.

    b. The rescuer uses the thumb and finger of his hand on the casualty's chin to pinch the nostrils closed when he breaks the seal over the casualty's mouth.

    c. The rescuer uses the thumb and finger of his hand on the casualty's forehead to pinch the nostrils closed before he blows into the casualty's mouth.

    d. The rescuer uses the thumb and finger of his hand on the casualty's forehead to pinch the nostrils closed when he breaks the seal over the casualty's mouth.

14. You have found an unconscious casualty who is not breathing. You have just perform the head-tilt/chin-lift procedure and tried to initiate rescue breathing. The casualty's airway, however, appears to be blocked. You should:

    a. Administer finger sweeps and manual thrusts.

    b. Begin chest compressions.

    c. Check for a pulse.

    d. Try to open his airway again and repeat the two ventilations.

15. Which of the following locations is correct for checking the casualty's pulse while performing rescue breathing.

    a. Over the casualty's "Adam's apple."

    b. The groove to the right of the casualty's "Adam's apple."

    c. The groove to the left of the casualty's "Adam's apple."

    d. Either b or c above.

16. You are administering rescue breathing to a casualty. You have checked the casualty's pulse and found that his heart is still beating. When do you check the casualty's pulse again?

    a. After each breath.

    b. After every 6 breaths.

    c. After every 12 breaths.

    d. Only after his heart stops beating.

17. When you are administering rescue breathing (no external chest compressions) using the mouth-to-nose method, you should administer ventilations at a rate of one ventilation every:

    a. Second.

    b. Two seconds.

    c. Five seconds.

    d. Twelve seconds.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 3

1. b (para 3-1)
2. d (paras 3-2 CAUTION, 3-4)
3. c (paras 3-2)
4. a (para 3-3b)
5. b (para 3-5c)
6. a (paras 3-6a(2), (3))
7. a (paras 3-6b(4), (5), (6))
8. b (para 3-6a(5))
9. d (paras 3-6, 3-7)
10. a (para 3-8b(1))
11. d (paras 3-7b, c, d)
12. a (para 3-9)
13. c (para 3-9a(3))
14. d (para 3-10b)
15. d (paras 3-11, 1-5d)
16. c (para 3-12b(3))
17. c (para 3-12a(7))

End of Lesson 3

LESSON ASSIGNMENT

LESSON 4	Perform Cardiopulmonary Resuscitation on an Adult.
TEXT ASSIGNMENT	Paragraphs 4-1 through 4-5.
TASKS TAUGHT	081-831-0046, Administer External Chest Compressions.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

4-1. Identify the proper procedures for performing one-rescuer CPR on an adult.

4-2. Identify the proper procedures for performing two-rescuer CPR on an adult.

4-3. Identify the proper procedures for switching positions while performing two-rescuer CPR.

4-4. Identify the proper procedures for switching from one-rescuer CPR to two-rescuer CPR.

4-5. Identify the causes of problems associated with CPR, including severe gastric distention, and how the problems can be corrected and/or prevented.

SUGGESTION After you have completed the text assignment, work the exercises at the end of this lesson before beginning the next lesson. These exercises will help you to achieve the lesson objectives.

LESSON 4

PERFORM CARDIOPULMONARY RESUSCITATION ON AN ADULT

4-1. ADMINISTER CARDIOPULMONARY RESUSCITATION TO AN ADULT USING THE ONE-RESCUER METHOD

There are two basic methods of administering cardiopulmonary resuscitation (CPR) to an adult casualty--the one-rescuer method and the two-rescuer method. The one-rescuer method is used when you have no one available to help you perform CPR. The two-rescuer method is used when you have an assistant available. The one-rescuer method is presented in this paragraph and the two-rescuer method is presented in paragraph 4-2. In this paragraph, it is assumed that you have already moved the casualty to safety if required (paragraph 3-1), checked for spinal injury (paragraph 3-4), opened the airway and administered two ventilations (paragraphs 3-6 through 3-9), found the airway unblocked or have removed any blockage (Lesson 5), and have found the casualty's carotid pulse to be absent (paragraph 3-11).

a. **Position the Casualty on a Firm Surface.** Chest compressions must be performed with the casualty lying on a firm surface. If you have not already placed the casualty on a firm surface, do so now. The casualty's body should be in the same position as used in initiating rescue breathing (paragraph 3-5).

b. **Position Yourself.** Kneel at the side of the casualty's chest.

c. **Call for Help Again.** If help has not arrived, call for help again. If an assistant is available, have him seek help (telephone, radio, and so forth). Remember, for the adult chain of survival (figure 4-1), you should phone first before initiating CPR.

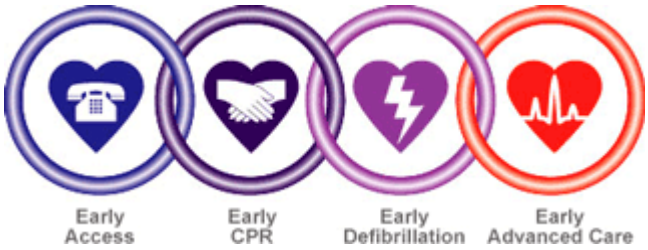


Figure 4-1. The chain of survival.

d. **Locate the Compression Area.** Locate the site on the casualty's chest where the force of the chest compression is to be applied. The method described below is normally used, but other methods can be used if they locate the same compression site.

(1) Take the index and middle finger of your hand that is nearest the casualty's feet and locate the lower edge of the casualty's rib cage (figure 4-2A).

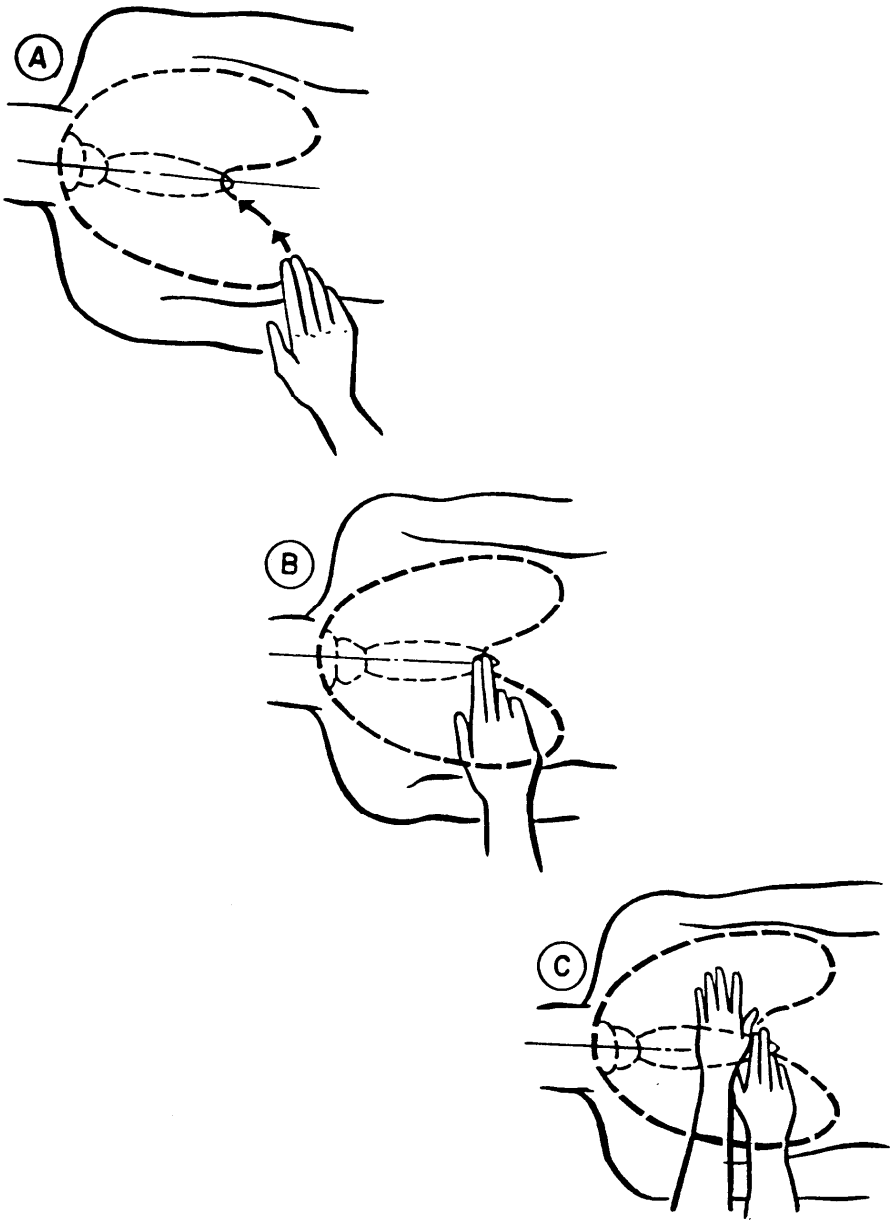


Figure 4-2. Locating the compression site for chest compressions.

(2) Push your fingers along the lower edge of the rib cage toward the center of his chest until you come to a notch. The notch is the location where the ribs meet the sternum, and where the xiphoid process begins.

(3) Place the tip of your middle finger in the notch and against the bottom of the sternum.

(4) Place your index finger next to the middle finger and over the sternum (figure 4-2B). The index finger is now above the xiphoid process.

NOTE: The xiphoid process is a bone shaped somewhat like an arrowhead. It is located at the bottom of the sternum. Force is **never** applied directly to the xiphoid process.

(5) Place the heel of your other hand so that the thumb side is next to your index finger (figure 4-2C). The heel is now over the lower half of the sternum and covers the compression site. Having the long axis of the heel of your hand placed along the long axis of the sternum keeps the main line of the force of compression on the sternum only rather than on the sternum and the ribs together. This decreases the chance of fracturing a rib during chest compressions. This hand position also ensures that the heel of the hand is not over the xiphoid process. A fractured rib or a xiphoid process that has broken free of the sternum can result in damage to the heart, lungs, and/or major blood vessels. It is common, even with proper CPR, to fracture a rib or ribs in the process of good resuscitation. The 2005 AHA guidelines state that it is extremely important to ensure proper force and depth of compressions and that this outweighs the risk associated with fracturing ribs.

e. **Position Hands for Compression.** Lift your hand that is closest to the casualty's feet (the one you ran along the bottom of the casualty's rib cage) and place the heel of that hand on top of the hand that is on the compression site. The long axis of both heels should be parallel with the long axis of the sternum with the fingers of both hands pointing away from you. Either extend the fingers of both hands so that the fingers are straight or interlace your fingers. (Figure 4-3 shows the fingers interlaced.) Keep your fingers and palms off the casualty's chest.

f. **Position Your Body to Deliver Compressions.** To be efficient and effective (the best heart compression for the least amount of energy expended), the thrust must be straight down. If the thrust is not straight down, the casualty's body will tend to roll. Such a rolling motion will decrease the force of the compression, lead to early fatigue on your part, and could cause fractured ribs or a fractured xiphoid process.

(1) Lock elbows. Straighten your arms and lock your elbows. If your elbows are not locked, your arms will bend somewhat when you deliver the compression and your compression will not be as effective.

(2) Position shoulders over hands. Move your shoulders so that they are directly over your hands and directly above the casualty's sternum. You will probably be at a point of imbalance when you assume this position. That is, you will feel that you would fall forward if you were not being supported by your hands on the casualty's chest. This imbalance actually helps in performing external chest compressions since your weight is added to the force of the compressions.

g. **Perform 30 Chest Compressions**. A compression consists of a thrust which compresses the heart and a release which allows the heart to refill with blood. These compressions are delivered at a rate of approximately 100 per minute. Figure 4-3 shows a rescuer delivering chest compressions. It is recommended to push hard and fast to make sure adequate depth and rate of compressions are maintained.

Figure 4-3. Rescuer administering chest compressions.

(1) Thrust. When performing the thrust, keep your elbows locked and push straight down. Do not push with all of your strength, but do use enough force to push the casualty's sternum down 1 1/2 to 2 inches (4 to 5 centimeters). Instead of pushing down using your muscles only, let the weight of your body move forward and use that force to help depress the sternum.

(2) Release. Releasing the pressure allows the heart to refill with blood. Release the pressure completely so that the sternum resumes its normal position, but do not remove the heel of your hand from the compression site.

NOTE: If you do lose the compression site, quickly repeat the procedures given in paragraphs d and e.)

(3) Rhythm. You should establish a definite rhythm when performing external chest compressions. The release part of the cycle should be equal in time to the thrust part of the cycle. Both parts should be distinct--do not "bounce." Use a system to keep the compressions regular, smooth, and uninterrupted. One system for keeping track of the number of compressions administered is given below.

(a) Count out loud, "One and two and three and four and five and six and seven and eight and nine and ten and eleven and twelve and thirteen and fourteen and fifteen and...."

(b) Push down on the sternum when you say a number.

(c) Release the pressure when you say "and."

h. **Administer Two Breaths**. Immediately after giving the thirtieth chest compression, move your hands to the casualty's head, open his airway (paragraph 3-6), and administer two breaths (paragraph 3-9). Each breath should take about 1 second to administer. Observe the casualty's chest out of the corner of your eye to make sure that the chest rises when you blow into the casualty's mouth (or nose or stoma). The procedure should be completed within 3 to 5 seconds.

i. **Prepare to Administer Chest Compressions**. After the second breath, relocate the compression site (landmark) over the lower half of the casualty's sternum. Use the procedure given in paragraph d. Do not guess where the site is located. Position your hands, lock your elbows, and move your shoulders over your hands.

j. **Perform Four More Cycles of Cardiopulmonary Resuscitation.** Administer four more CPR cycles. A one-rescuer CPR cycle is sometimes referred to as a 30:2 cycle. Each cycle consists of administering 30 chest compressions (paragraph g) followed by administering two breaths (paragraph h). You have now administered five complete CPR cycles (150 compressions and 10 breaths). About 2 minutes have elapsed since you began the first cycle.

k. **Check for Pulse and Breathing**. After you have administered the two full breaths of the fifth CPR cycle, check the carotid pulse (paragraph 3-11) again to see if his heart has resumed beating on its own. At the same time, check for signs that spontaneous breathing has resumed (paragraph 3-7). The check should take about 5 seconds. CPR should not be stopped for more than 10 seconds.

l. **Evaluate Your Findings**.

(1) If the casualty has resumed adequate breathing on his own, stop administering CPR and begin checking for other injuries. Remember to keep his airway open and check his breathing every few minutes if he does not regain consciousness. Resume administering rescue breathing or CPR if the breathing stops.

(2) If the casualty has a pulse, but has not resumed breathing on his own, proceed to administer rescue breathing (paragraph 3-12). Check the casualty's pulse after every 12 breaths. If you find the casualty's pulse to be absent, resume administering CPR.

(3) If the casualty does not have a pulse, give the casualty two full breaths and resume administering CPR. (Note: If there is no possibility of help arriving unless you make a telephone or radio call and a telephone or radio is readily available, quickly telephone or radio for help.) Continue to check for the return of pulse and breathing after every five cycles (5 cycles = approximately 2 minutes) of compression/ventilation.

m. **Evacuate the Casualty**. If possible, evacuate the casualty to a medical treatment facility. Continue administering CPR or rescue breathing en route if needed. If the casualty is breathing on his own, continue to observe him and be prepared to resume administering CPR since his condition could deteriorate rapidly without warning. Even if the casualty appears to recover, he needs to be examined by a physician as soon as possible.

n. **Terminate Efforts, If Required**. Keep administering CPR until one of the following occurs.

(1) The casualty's heart resumes beating adequately on its own. (If this happens, continue rescue breathing.)

(2) The casualty's heart resumes beating on its own and he also resumes breathing adequately on his own. (If this happens, look for injuries.)

(3) You are joined by another qualified person. (If this happens, change to two-rescuer CPR as described in paragraph 4-3.)

(4) You are relieved by a physician or other medical personnel. (If this happens, perform other duties as required.)

(5) You are ordered to stop by a physician or other qualified person authorized to pronounce the casualty as being dead. (In a military treatment facility, only a physician has this authority.)

(6) You are too exhausted to continue.

CAUTION: In general, when in the tactical environment, serious consideration should be given before administering CPR to the combat casualty. Cardiopulmonary resuscitation actions require your entire concentration and will prohibit you from attending to casualties that you may be able to save.

4-2. ADMINISTER CARDIOPULMONARY RESUSCITATION TO AN ADULT USING THE TWO-RESCUER METHOD

If you have another person qualified to administer CPR ready to help you, two-rescuer CPR should be performed. In two-rescuer CPR, one rescuer is responsible for administering chest compressions while the other rescuer is responsible for administering ventilations. In this paragraph, it is assumed that you have already moved the casualty to safety if required (paragraph 3-1), checked for responsiveness (paragraph 3-2), called for help (paragraph 3-3), checked for spinal injury (paragraph 3-4), and positioned the casualty on his back on a firm surface (paragraph 3-5). It is also assumed a soldier who is qualified to perform two-rescuer CPR has answered your call for help.

a. **Position Yourselves**. One rescuer positions himself at the side of the casualty's head. This rescuer (called the ventilator rescuer from now on) will administer ventilations to the casualty. The other rescuer positions himself at the casualty's chest on the opposite side from the ventilator rescuer (figure 4-4). The second rescuer (called the compressor rescuer from now on) administers the chest compressions. Rescuers should be on opposite sides of the casualty so that each rescuer has room to perform two-rescuer CPR. If both rescuers must be on the same side (in a ground ambulance, for example), both rescuers must be careful to avoid accidental contact which could interfere with the efficiency of their CPR efforts.

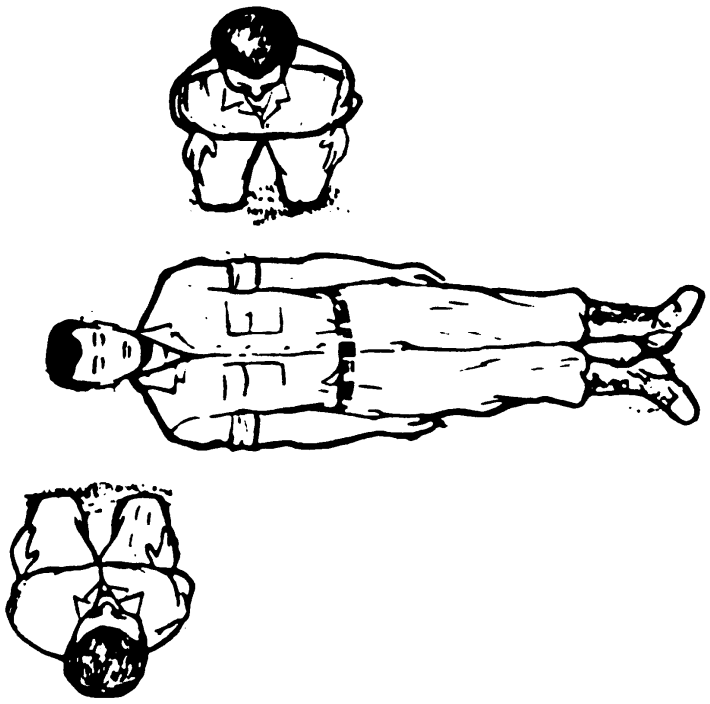


Figure 4-4. Rescuers positioned for two-rescuer CPR.

b. **Evaluate Casualty.** The ventilator rescuer (the rescuer at the casualty's head):

(1) Opens the casualty's airway (paragraph 3-6).

(2) Checks for signs of breathing (paragraph 3-7).

(3) Administers two full breaths if spontaneous breathing is not present and observes the casualty's chest to make sure that it rises (paragraph 3-9).

(a) If the airway is blocked, the ventilator rescuer opens the casualty's airway more and tries to administer two ventilations again. If the ventilations are unsuccessful, he tells the compressor rescuer to administer thrusts (paragraph 5-6f) while he (ventilator rescuer) performs finger sweeps (paragraphs 5-6c) as needed until the obstruction is removed.

(b) After the obstruction is removed, the ventilator rescuer administers two breaths and two-rescuer CPR is continued.

(4) Checks for a pulse by feeling the carotid artery for 5 to 10 seconds (paragraph 3-11).

(5) Informs the compressor rescuer of the need for chest compressions by saying, "No pulse," if a pulse is not detected.

c. **Prepare for Chest Compressions**. While the ventilator rescuer is evaluating and ventilating the casualty, the compressor rescuer (the rescuer at the casualty's chest):

(1) Locates the site for administering chest compressions (paragraph 4-1d).

(2) Positions himself to administer the compressions (paragraphs 4-1e and 4-1f).

d. **Administer 30 Compressions**. When the ventilator rescuer says, "No pulse," the compressor rescuer administers 30 chest compressions at the rate of approximately 100 compressions per minute. The sternum is depressed 1 1/2 to 2 inches with each compression.

(1) The force of the compression should be delivered straight down without rocking the casualty. The fingers should not touch the casualty.

(2) The release part of the compression should be equal in time to the thrust part of the compression. Both parts should be distinct (no bounce).

(3) The compressor rescuer must keep his compressions regular and keep track of compression by counting out loud, "one and two and three and four and five and…." He must also push fast and hard to ensure a fast enough rate of compressions and adequate depth.

(a) The compressor rescuer pushes down on the sternum when he says a number.

(b) The compressor rescuer releases the pressure when he says, "and."

e. **Administer Two Breaths**. After the compressor rescuer says "thirty," the ventilator rescuer blows two breaths into the casualty's mouth (or nose). This must be done while the chest compression is in the "release" portion. If the ventilator rescuer blows air into the casualty's lungs while the compressor rescuer is performing the "push" portion of a chest compression, the actions would interfere with each other and be inefficient. Each ventilation should take about 1 second.

f. **Continue Cardiopulmonary Resuscitation Cycles**. After the ventilator rescuer administers the ventilations, the compressor rescuer administers 30 more chest compressions. Although there is a slight break between the last compression of a cycle and the first compression of the next cycle to allow for the ventilation, the compressor rescuer should not remove his hands from the casualty's chest between cycles. While the compressor rescuer is delivering compressions, the ventilator rescuer feels the casualty's pulse to ensure that the compressions are being effective. Both rescuers continue administering two-rescuer CPR cycles until 5 cycles have been administered. Each two-rescuer CPR cycle (sometimes called a 30:2 cycle) consists of thirty chest compressions followed by two full ventilations. At this rate, a casualty will actually receive about 150 compressions and 10 breaths after two minutes.

g. **Check for Spontaneous Pulse and Respiration**. After the first five cycles (2 minutes), the compressor rescuer stops administering compressions and the ventilator rescuer checks for spontaneous pulse and respiration. The check should take about 5 seconds.

(1) If the casualty has spontaneous heartbeat and respiration, the ventilator rescuer informs the compressor rescuer that the casualty is breathing on his own. The compressor rescuer then checks the casualty for injuries while the ventilator rescuer continues to maintain the casualty's airway and monitor the casualty's respirations and pulse.

(2) If the casualty's heart is beating on its own, but the casualty is not breathing on his own, then the ventilator rescuer informs the compressor rescuer of the situation and begins administering rescue breathing. The compressor rescuer then checks for other injuries. If the casualty's pulse stops again, two-rescuer CPR is resumed.

(3) If no pulse is detected after checking for 5 seconds, the ventilator rescuer opens the casualty's airway, administers two breaths, and says, "No pulse." The compressor rescuer resumes administering chest compressions and two-rescuer CPR is continued.

h. **Continue Cardiopulmonary Resuscitation Cycles and Checks**. If the pulse is absent, continue to administer two-rescuer CPR using the cycle of thirty chest compressions followed by two breaths. After administering CPR for about two minutes, both rescuers stop their efforts and the ventilator rescuer checks the casualty for spontaneous pulse and breathing. If the check shows no change, two-rescuer CPR is resumed. A check is made every five cycles (about every 2 minutes).

i. **Switch When Needed**. If the rescuer administering chest compressions becomes tired, the rescuers can switch functions. (Note: The same general procedures can be used if another qualified rescuer appears and wishes to give one of the rescuers a rest.) It is important to change compressors about every two minutes to ensure adequate rate and depth of compressions.

(1) The rescuer administering the chest compressions calls for the switch by counting "CHANGE and two and three and four and five…"

(2) After the compressor rescuer gives the thirtieth chest compression, he moves to the position for giving rescue breathing at the casualty's head without moving to the casualty's other side.

(3) The ventilator rescuer administers two breaths after the thirtieth compression and moves to the casualty's chest without changing sides.

(4) The rescuer at the casualty's head (formerly the compressor rescuer, now the ventilator rescuer) checks for spontaneous heartbeat and breathing (about 5 seconds).

(5) The other rescuer (formerly the ventilator rescuer, now the compressor rescuer) locates the chest compression site and positions himself to deliver chest compressions.

(6) If the casualty still has no pulse, the new ventilator rescuer says, "No pulse," and administers two ventilations. The new compressor then begins administering chest compressions. Both rescuers continue to administer two-rescuer CPR.

(a) If the casualty's heart has resumed beating but the casualty is not breathing, the new ventilator rescuer continues to administer rescue breathing while the other rescuer looks for injuries.

(b) If the casualty has spontaneous pulse and respiration, the new ventilator rescuer maintains the casualty's airway and monitor his respirations and pulse, while the other rescuer checks the casualty for injuries.

j. **Evacuate the Casualty**. If possible, evacuate the casualty to a medical treatment facility. Continue administering CPR or rescue breathing as needed. If the casualty is breathing on his own, one must monitor his respirations and pulse closely, since his condition could deteriorate rapidly without warning.

k. **Terminate Efforts, If Required**. Keep administering CPR until one of the following occurs.

(1) The casualty's heart is beating on its own.

(2) You are relieved by another qualified person.

(3) You are ordered to stop by a physician or other authorized person.

(4) You are too exhausted to continue your efforts.

4-3. CHANGE FROM ONE-RESCUER CARDIOPULMONARY RESUSCITATION TO TWO-RESCUER CARDIOPULMONARY RESUSCITATION

One of the first actions a lone rescuer takes is to call for help. If another person who is qualified to administer CPR comes to his aid after he has begun one-rescuer CPR, he can change from one-rescuer CPR to two-rescuer CPR. In the procedures given below, the original rescuer (the one administering one-rescuer CPR) is called the first rescuer. The new person coming to help the first rescuer is called the second rescuer.

a. **Identify Self**. The second rescuer informs the first rescuer that he is qualified to assist the first rescuer by saying, "I know CPR," or a similar comment.

b. **Kneel**. The second rescuer positions himself on the opposite side of the casualty from the first rescuer in order to give each rescuer room to perform his functions and to lessen the chance of physical contact between the rescuers. The second rescuer then kneels near the casualty's chest in position to administer chest compressions.

NOTE: The first rescuer continues to perform one-rescuer CPR while the second rescuer identifies and positions himself.

c. **Administer Chest Compressions.** After the first rescuer administers two full breaths to the casualty, the second rescuer administers thirty chest compressions. The first rescuer remains at the casualty's head and checks the casualty's carotid pulse to determine the effectiveness of the chest compressions.

(1) If the second rescuer's chest compressions are actually causing the heart to pump blood, a pulse will be felt.

(2) If no pulse is felt within 5 seconds, the first rescuer informs the second rescuer that no pulse is being felt. The second rescuer then alters his compression technique so that a pulse is felt.

d. **Continue Efforts to Aid Casualty**.

(1) If the casualty has spontaneous heartbeat and respiration, one rescuer can check the casualty for additional injuries while the other rescuer continues to monitor the casualty.

(2) If the casualty's heart is beating on its own but the casualty is not breathing on his own, the one rescuer administers rescue breathing while the other rescuer looks for injuries.

(3) If no pulse is detected after checking for 5 seconds, the first rescuer opens the casualty's airway, administers two breaths, and says, "Continue CPR." The second rescuer resumes administering chest compressions. Both rescuers now administer CPR using two-rescuer CPR cycles (thirty compressions followed by two ventilations). After five cycles, the rescuers again check for spontaneous heartbeat and respiration, and change positions.

(4) If the first rescuer is fatigued, the first rescuer administers two ventilations and tells the second rescuer to administer one-rescuer CPR. While the second rescuer is performing one-rescuer CPR, the first rescuer checks the effectiveness of the ventilations by observing the casualty's chest, checks the effectiveness of the compressions by feeling for a carotid pulse, and (if needed) seeks additional help. When the first rescuer has recovered sufficiently, he informs the second rescuer that he will assist in administering two-rescuer CPR, positions himself by the casualty's head, and checks for spontaneous heartbeat and spontaneous respiration (paragraph d).

4-4. CONTROL COMPLICATIONS WHILE PERFORMING CARDIOPULMONARY RESUSCITATION

a. **Gastric Distention**. During rescue breathing or CPR, air may enter the casualty's esophagus (the tube leading from the throat to the stomach) and cause the stomach to inflate. This condition is called gastric distention. Gastric distention can be caused by the rescuer delivering the ventilations with too much force, by improperly positioning the casualty's head (airway not open), or by an obstruction in the casualty's airway preventing his lungs from filling quickly. Gastric distention can cause vomiting and may decrease the lung volume by pushing up on the diaphragm.

(1) If the stomach becomes distended, reposition the casualty's airway. Watch for the rise and fall of the casualty's chest, and breathe only hard enough to cause the chest to fully rise. Continue administering rescue breathing or CPR. Do not push on the casualty's abdomen in an attempt to reduce the distention since the pressure could cause the casualty to vomit.

(2) Gastric distention can be corrected by adjusting the airway and adjusting the force of the ventilations. More advanced procedures may be appropriate, such as the use of a nasogastric tube to decompress the abdomen. If this is not available, then proper ventilation and opening of the airway are the primary methods to reduce further distention.

b. **Vomiting (Regurgitation)**. If the casualty vomits, roll the casualty onto his side so that his front is toward you and administer a finger sweep to wipe out his mouth. Then return him to the supine (flat on his back) position. If possible, suction the patient to clear the airway. Then continue administering CPR or rescue breathing.

c. **Dentures**. Dentures support the rescuer's lips and make sealing the casualty's mouth easier. Do not remove dentures from the casualty's mouth unless they are loose or broken. If it is necessary to remove dentures, put them in the casualty's pocket so that they will accompany the casualty when he is evacuated. If dentures are blocking the casualty's airway, perform a finger sweep to remove them (paragraph 5-6c).

d. **Fractures**. Fractures of the ribs or sternum may occur even if CPR is performed properly. Care should be taken to ensure proper hand placement and technique in order to reduce the danger of fractures. Fractures of the ribs or sternum (including the xiphoid process) can puncture or lacerate a lung, liver, aorta, stomach, or heart. Cardiac tamponade (blood in the pericardial sac) is caused by a lacerated pericardium. If injuries occur, continue performing CPR.

e. **Biological Death**. Cardiopulmonary resuscitation is not always successful. Success or failure may be influenced by the time that elapsed before CPR was started, injuries, drugs, poisons, and/or preexisting conditions such as heart disease, kidney failure, and stroke. You should not blame yourself or others for failure to save the casualty if a sincere effort was made to revive the casualty.

4-5. SUMMARY OF CARDIOPULMONARY RESUSCITATION PROCEDURES

a. Check for responsiveness and for spinal injury.

b. Call for help; place casualty on his back and on a firm surface.

c. Open the airway.

d. Check breathing (look, listen, feel).

e. Give two breaths.

f. Check carotid pulse.

g. Locate compression site.

h. Administer CPR cycles (thirty compressions to two ventilations).

i. Check for spontaneous breathing and heartbeat after five cycles of 30:2 (about 2 minutes).

j. Continue CPR, rechecking for spontaneous breathing and heartbeat every minute.

k. Evacuate the casualty.

Continue with Exercises

EXERCISES, LESSON 4

INSTRUCTIONS: Circle the letter of the response that BEST completes the statement or BEST answers the question. After you have completed all of the exercises, turn to "Solutions to Exercises" at the end of the lesson exercises and check your answers. For each exercise answered incorrectly, reread the material referenced after the solution.

1. When performing the chest compression portion of CPR, you should push down on the lower half of the:

   a. Ribs.

   b. Spine.

   c. Sternum.

   d. Xiphoid process.

2. When performing chest compressions on an adult casualty, you should push the sternum down about:

   a. 1 inch.

   b. 2 inches.

   c. 3 inches.

   d. 4 inches.

3. When performing one-rescuer CPR, you should administer _____ chest compression(s) followed by _____ full breath(s).

   a. One; one.

   b. Five; one.

   c. Fifteen; two.

   d. Thirty; two.

4. A CPR casualty should be lying on a _____ surface.

   a. Firm.

   b. Soft.

5. When performing the chest compression portion of one-rescuer CPR cycles, you should administer _____ chest compressions within about _____ seconds.

   a. Five; three.

   b. Five; five.

   c. Thirty; twenty.

   d. Fifteen; sixty.

6. You are performing one-rescuer CPR. You should check the casualty's pulse:

   a. After every five cycles.

   b. After the casualty regains consciousness.

   c. After every ventilation.

   d. After the first minute of CPR; then every 3 to 5 minutes thereafter.

7. When two-rescuer CPR is performed, _____ chest compression(s) are followed by _____ full breath(s).

   a. One; one.

   b. Thirty; two.

   c. Fifteen; two.

   d. Sixty; eight.

8. You are performing one-rescuer CPR and notice that the casualty's stomach region is enlarged due to moderate gastric distention. You should:

   a. Readjust the casualty's airway and adjust the force of ventilations.

   b. Perform abdominal thrusts until the condition is corrected.

   c. Perform chest thrusts until the condition is corrected.

   d. Ignore the condition since it is to be expected.

9. Two rescuers are performing CPR on a casualty. If possibe, the rescuers should be on _____ of the casualty.

   a. Opposite sides.

   b. The same side.

10. When rescuers performing two-rescuer CPR on a casualty decide to switch functions, they _____ switch sides.

    a. Do.

    b. Do not.

11. You come upon a rescuer performing one-rescuer CPR on a casualty. After you identify yourself, you should assist the first rescuer by taking over the administration of:

    a. Chest compressions.

    b. Ventilations.

12. Two rescuers are performing CPR on a casualty. The rescuer performing chest compressions calls out, "CHANGE." The rescuer administering rescue breathing:

    a. Administers one breath and moves to the casualty's chest.

    b. Waits until the other rescuer gives thirty chest compressions, then administers two breaths and moves to the casualty's chest.

    c. Administers one breath, checks for spontaneous pulse and breathing, and moves to the casualty's chest.

    d. Waits until the other rescuer gives five chest compressions, checks for spontaneous pulse and breathing, and moves to the casualty's chest.

13. You are performing one-rescuer CPR. How long should you continue administering CPR?

    a. Until the casualty recovers.

    b. Until you are relieved by a qualified person.

    c. Until you are too exhausted to continue administering CPR.

    d. All of the above are appropriate responses.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 4

1. c (para 4-1d(5))
2. b (para 4-1g(1))
3. d (para 4-1j)
4. a (para 4-1a)
5. c (paras 4-1g, j)
6. a (paras 4-1k, 4-1l(3))
7. b (para 4-2f)
8. a (para 4-4a(2))
9. a (para 4-2a)
10. b (paras 4-2i(2), (3))
11. a (para 4-3c)
12. b (para 4-2i(3))
13. d (para 4-1n)

End of Lesson 4

LESSON ASSIGNMENT

LESSON 5	Remove an Upper Airway Obstruction in an Adult.
TEXT ASSIGNMENT	Paragraphs 5-1 through 5-7.
TASK TAUGHT	081-831-0019, Clear an Upper Airway Obstruction.
LESSON	After completing this lesson, you should be able to:

5-1. Identify common causes of upper airway obstruction.

5-2. Identify signs of respiratory distress.

5-3. Given a situation, determine the best way to aid a casualty with an airway blockage.

5-4. Identify the proper procedures for performing abdominal thrusts on a casualty with an airway obstruction if the casualty is standing or sitting.

5-5. Identify the proper procedures for performing chest thrusts on a casualty with an airway obstruction if the casualty is standing or sitting.

5-6. Identify the proper procedures for performing abdominal thrusts on a casualty with an airway obstruction if the casualty is unconscious or lying down.

5-7. Identify the proper procedures for performing chest thrusts on a casualty with an airway obstruction if the casualty is unconscious or lying down.

SUGGESTION After you have completed the text assignment, work the exercises at the end of this lesson before beginning the next lesson. These exercises will help you to achieve the lesson objectives.

LESSON 5

REMOVE AN UPPER AIRWAY OBSTRUCTION IN AN ADULT

5-1. RECOGNIZE COMMON CAUSES OF UPPER AIRWAY OBSTRUCTION

An object lodged in the airway of a casualty who is conscious can result in unconsciousness, clinical death, and biological death. An airway obstruction can also prevent proper ventilation of an unconscious casualty when rescue breathing or CPR is being administered. Common causes of airway obstruction are discussed below.

a. **Food.** Food which is not swallowed properly can enter the trachea (part of the respiratory system) instead of the esophagus (part of the digestive system). In conscious adults, meat which has not been properly chewed is the most common food obstruction. In small children, objects that can be treated like food (small buttons, for example) are common causes of airway obstruction.

b. **Vomitus**. Stomach contents expelled during the act of vomiting are referred to as vomitus. A casualty who inhales while vomitus is still in his mouth or pharynx can cause the vomitus to enter the airway. Inhaling vomitus is a common cause of airway obstruction in unconscious or semiconscious casualties. An elevated blood alcohol level can contribute to this problem.

c. **Blood Clots**. Injuries to the head or facial areas (nose, cheeks, and so forth) can cause blood clots to form in the mouth, nose, or nasal cavities. These clots can become loose and be inhaled into the trachea. Obstructions caused by blood clots are more likely to occur in unconscious casualties than in conscious casualties.

d. **Tongue**. The tongue can block the airway if the tongue muscles relax and fall back into the pharynx. A relaxed tongue is the most common cause of airway obstruction in unconscious casualties.

e. **Other Objects.** Other objects, such as dentures, can also result in blockage. Objects lodged in the upper esophagus can also press against the trachea and reduce the airflow through the trachea.

5-2. RECOGNIZE A PERSON IN RESPIRATORY DISTRESS

A casualty who is conscious and has an object lodged in his airway will begin to cough or at least try to cough. He will probably have a distressed look on his face and be clutching his throat. This clutching action is natural, but it has also been adopted as the universal signal for choking (figure 5-1). Bluish coloration (cyanosis) of the lips, interior of the mouth, and nail beds are indications of low oxygen content in the blood. Any unconscious casualty should be examined to see if he is breathing. Even if the casualty is breathing, perform periodic checks to make sure he is continuing to breathe.

Figure 5-1. Universal distress signal for choking.

5-3. CLASSIFY THE SEVERITY OF THE BLOCKAGE

Airway blockage can be divided into two major classifications--partial blockage and complete blockage. In partial blockage, some air can still be inhaled and exhaled. In complete blockage, air flow stops. Partial blockage can be further divided into partial blockage with "good" air exchange and partial blockage with "poor" air exchange. In order to evaluate the severity of the obstruction, tell the casualty to speak to you ("Talk to me. Are you choking?" and so forth).

a. **Partial Airway Obstruction with Good Air Exchange.** If a casualty with a partial obstruction can speak or can cough forcefully, he has "good" air exchange. Good air exchange indicates that the casualty can still inhale and exhale enough air to carry on all life processes. A casualty may have good air exchange even if he makes a wheezing sound between coughs.

b. **Partial Airway Obstruction with Poor Exchange.** "Poor" air exchange is indicated by a weak and ineffective cough, high-pitched noises (strider, like crowing) while inhaling, and increasing difficulty in breathing. Cyanosis may also be present. A casualty with poor air exchange is not inhaling and exhaling a sufficient amount of air. If the casualty is not helped, he will probably loose consciousness and die.

c. **Complete Airway Obstruction**. A casualty who has a complete airway obstruction cannot breathe, speak, or cough. If the obstruction is not removed quickly, he will become unconscious due to the decreased supply of oxygen to the brain. If respiration is not restored, his heart will stop beating about 30 seconds after he looses consciousness.

5-4. ASSIST A CASUALTY WITH GOOD AIR EXCHANGE

a. **Encourage the Person**. A casualty who has an obstruction in his airway and still has good air exchange will naturally attempt to clear his airway by coughing. Do not interfere with the casualty's attempts to expel the obstruction. If possible, have the casualty to lower his head below chest level. When the head is lower than the chest, gravity will help to expel the obstruction. Do not use manual thrusts described in the following paragraphs as long as the casualty is making adequate attempts to expel the blockage himself.

b. **Call for Help.** If the casualty cannot expel the obstruction through his own efforts, you may need someone to assist you in your efforts and/or to obtain medical help.

c. **Remain With the Casualty.** Good air exchange can quickly change to poor air exchange or complete blockage. Do not leave the casualty to seek additional medical help, but do send someone else to obtain aid if anyone is available. Give the casualty calm support. Be prepared to administer the procedures given in the following paragraphs if his condition goes from good air exchange to poor air exchange or complete blockage or if he looses consciousness. Even if the casualty does remove the airway obstruction on his own, the casualty may still need medical attention if his trachea has been injured.

5-5. ASSIST A STANDING OR SITTING CONSCIOUS CASUALTY WITH POOR AIR EXCHANGE OR COMPLETE BLOCKAGE

A casualty with poor air exchange is treated as though he has a complete blockage since both conditions can result in unconsciousness and death if the obstruction is not removed.

a. **Call for Help.** If you are alone, yell for help unless a combat situation dictates otherwise. If you have someone with you, have him obtain medical help (telephone, radio, run to get professional medical help, and so forth) if it can be done quickly. If only one person is available, have him obtain medical help and then return to assist you. You may need his help to perform two-rescuer cardiopulmonary resuscitation should the casualty's heart stop beating.

b. **Position Yourself Behind the Casualty.** Stand behind the casualty, slide your arms under his arm, and try to wrap your arms around his waist. This helps to support the casualty and helps you to determine whether abdominal thrusts or chest thrusts should be used.

c. **Administer Manual Thrusts.** A manual thrust acts like an artificial cough by forcing air out of the casualty's lungs. The increased air pressure caused by the thrusts should dislodge the obstruction and cause it to be expelled. The thrust may be administered either to the casualty's abdomen or to the casualty's chest. The abdominal thrust is usually preferred, but the chest thrust is used if the casualty is noticeably pregnant, if the casualty has abdominal injuries, or if the casualty is so large that you cannot wrap your arms around his waist. Do not alternate between abdominal and chest thrusts. Each manual thrust is performed with the intent of dislodging the obstruction.

(1) Abdominal thrusts.

(a) Wrap your arms around the casualty's waist.

(b) Make a fist with one hand. Place the fist against the casualty's abdomen in the midline slightly above the navel and well below the tip of the xiphoid process. The thumb side of your fist should be against the abdomen (figure 5-2 A). Never place your fist over the xiphoid process or over the lower margin of the rib cage. A thrust delivered directly to the xiphoid process or ribs can result in a fractured sternum (xiphoid process separated from sternum) and/or fractured ribs.

(c) Grasp your fist with your other hand (figure 5-2 B).

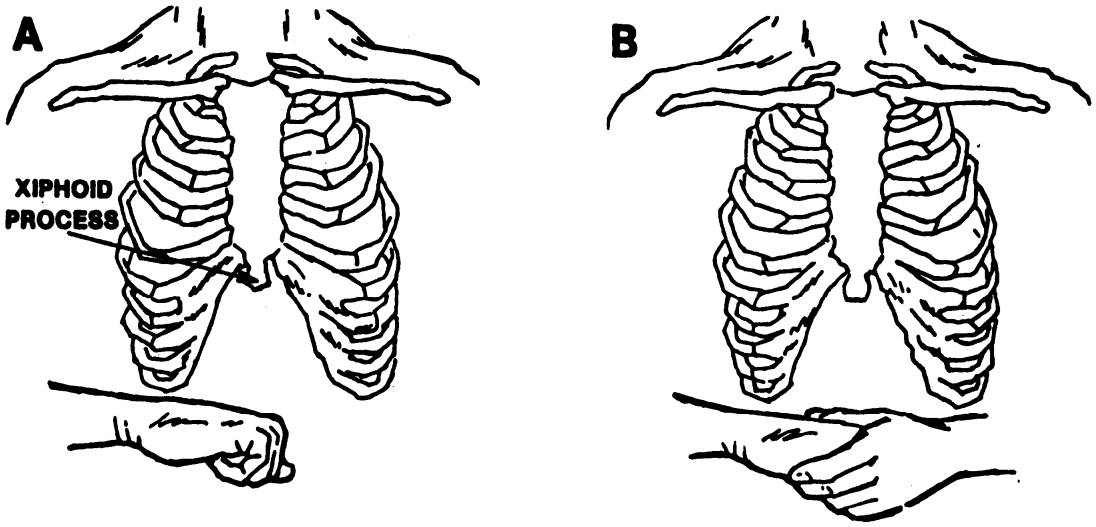


Figure 5-2. Placement of hands for administering an abdominal thrust to a casualty standing or sitting.

(d) Thrust into the casualty's abdominal region (figure 5-3) using a quick inward and upward motion, and then relax the hold.

Figure 5-3. Administering an abdominal thrust to a standing casualty.

(e) Continue administering abdominal thrusts until the obstruction is expelled or until the casualty loses consciousness. If the casualty loses consciousness, proceed to administer the finger sweep and modified abdominal thrusts described in paragraph 5-6. Vomiting may occur when the abdominal thrust is used. Clear any vomitus from the casualty's mouth so he will not inhale the vomitus.

(2) Chest thrusts.

(a) Place your arms directly under the casualty's armpits and encircle his chest with your arms.

(b) Make one hand into a fist and place the thumb side of the fist against the lower half of the casualty's sternum. Make sure that the fist is placed above the xiphoid process and the lower margin of the rib cage. Also make sure that the fist rests on the sternum and not on the ribs.

(c) Grasp your fist with your free hand.

(d) Deliver a quick inward thrust (figure 5-4); then relax the hold. The thrust should depress the casualty's sternum 1 1/2 to 2 inches.

(e) Continue administering chest thrusts until the obstruction is expelled or until the casualty loses consciousness.

Figure 5-4. Administering a chest thrust to a standing casualty.

d. **Position Casualty for Modified Thrusts, If Needed.** If the casualty loses consciousness while you are performing manual thrusts, continue to support the casualty's weight and gently lay the casualty on his back with his arms at his sides. Support the casualty's head as you lower him. Make sure that the casualty is lying on a firm surface since you may need to administer CPR once the obstruction is expelled.

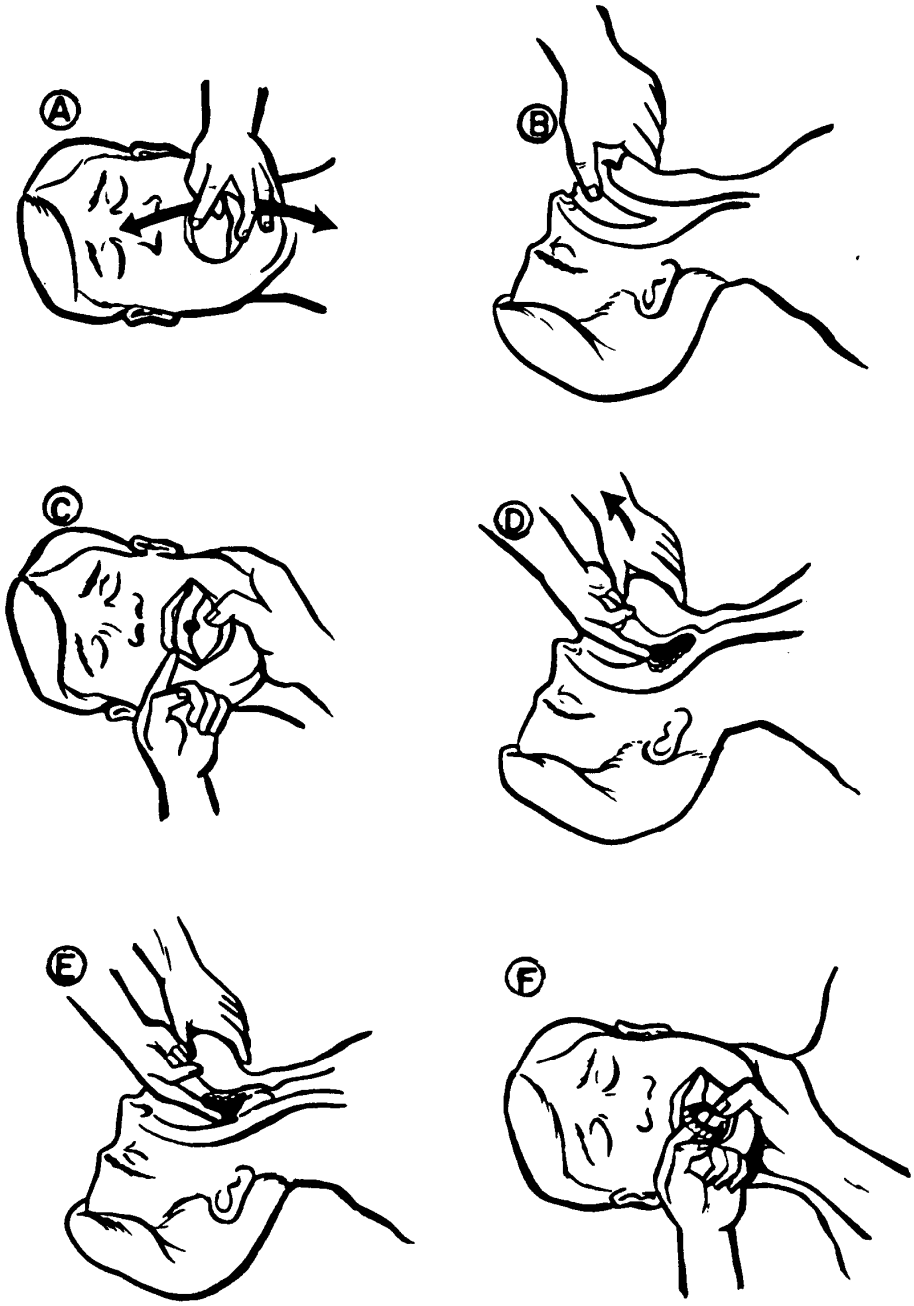
5-6. REMOVE AN AIRWAY OBSTRUCTION IN AN UNCONSCIOUS CASUALTY OR A CASUALTY WHO IS LYING ON HIS BACK

The procedures given in this paragraph are used to expel an airway obstruction when a casualty with poor air exchange or complete blockage is conscious and lying down, when a standing or sitting casualty becomes unconscious during efforts to expel the obstruction, or when an obstruction is discovered during an attempt to perform rescue breathing or CPR.

a. **Position Casualty.** Place the casualty on a flat, hard surface in a supine (on his back) position if he is not already in this position.

b. **Call for Help.** If you have not already sent for help, send someone to get additional medical help.

c. **Administer Finger Sweep.** A finger sweep is performed in an attempt to remove blockage. Finger sweeps are performed only if the casualty is unconscious. Manual thrusts may dislodge an object which could not be reached when you began your rescue efforts. When you can remove a foreign object from a casualty's mouth, do so. Care must be used in helping a conscious casualty remove an object from his mouth because your actions may trigger his "gag reflex." Do not use the finger sweep technique with a conscious casualty. The procedures for performing a finger sweep are given below and in figure 5-5.



A Cross-finger method of opening mouth. **B** Tongue-jaw lift.
C Inserting finger. **D** Sweeping motion.
E Trapping obstruction. **F** Removing obstruction.

Figure 5-5. Performing a finger sweep on an unconscious casualty.

(1) Position the casualty's head so that his face is up.

(2) Open the casualty's mouth. If the casualty's mouth does not open readily, use the crossed-finger method of opening the mouth.

(a) Cross the index finger and thumb of one hand.

(b) Place the tip of the thumb and the tip of the index finger against opposite sets of teeth on the cutting or grinding edge of the teeth.

(c) Slide the thumb and index finger across each other in opposite directions to separate the upper and lower teeth and open the casualty's mouth.

(3) Open the casualty's airway by grasping his tongue and lower jaw between your thumb and finger and lifting the tongue and jaw. This procedure, called the tongue-jaw lift, moves the tongue away from the back of the casualty's throat. By lifting the tongue and jaw, the casualty's airway is opened further and foreign objects are easier to locate. In addition, repositioning the casualty's tongue and jaw may loosen an object in the airway enough to allow air to move past it.

(4) Look into the casualty's mouth to see if you can locate the object causing the blockage. Perform the finger sweep even if you cannot visually locate the object.

(5) Insert the index finger of your free hand along the inside of the casualty's cheek down to the base of his tongue.

(6) Sweep the throat with a "hooking" motion. A foreign object may be dislodged as you move your finger from the side of his throat toward the center. You may need to push the object to the side of the throat and trap it before removing the object. Be sure that you do not force the object deeper into the airway. If the casualty is wearing dentures, remove the dentures if they interfere with sweeping the mouth.

(7) If an object is located and can be removed, lift the object with your "hooking" finger and remove the object from the casualty's throat and mouth.

d. **Administer Two Ventilations.** After performing the finger sweep, open the casualty's airway using the head-tilt/chin-lift or jaw-thrust (paragraph 3-6) and attempt to administer two full breaths (paragraph 3-9). This procedure should take between 3 to 5 seconds.

(1) If your attempts to ventilate are successful, check for spontaneous breathing. If the casualty does not breathe on his own, perform rescue breathing or CPR as appropriate.

(2) If your attempts are not successful (chest does not rise), reposition the airway and try to ventilate the casualty again.

(a) If your second attempt to ventilate is successful, check for spontaneous breathing. If the casualty does not breathe on his own, perform rescue breathing or CPR if needed.

(b) If your attempts are still not successful, the airway is still being blocked. Call again for help (if appropriate) and proceed to administer modified abdominal or modified chest thrusts.

e. **Maintain Airway.** Adjust the casualty's head so that it is face up and the airway is open. If an assistant is present, have him keep the casualty's airway open using the head-tilt/chin-lift or jaw-thrust method, as appropriate.

f. **Administer Modified Manual Thrusts.** Manual thrusts are performed in an attempt to expel the object blocking the casualty's airway. The procedures for administering abdominal and chest thrusts given in paragraph 5-5c must be modified since the casualty is now lying on his back. Each thrust is delivered with the aim of expelling the obstruction without having to administer additional thrusts. Administer modified abdominal thrusts unless the casualty is in the latter stages of pregnancy, the casualty has abdominal injuries, or the casualty is so overweight that abdominal thrusts will not be effective. If one of these conditions exists, administer modified chest thrusts.

(1) <u>Abdominal thrusts</u>.

(a) Straddle the casualty's thighs. If the casualty is larger than you, it may be necessary to straddle only one of his thighs.

(b) Place the heel of one hand against the casualty's abdomen on the midline slightly above his navel and well below his xiphoid process. (This is the same location as for the standing abdominal thrust.)

(c) Place your other hand on top of the hand on the casualty's abdomen. Fingers can be interlaced or extended away from your body.

(d) Press down with an inward and upward thrust (figure 5-6). Keep your arms straight and do not push to either side. Use your body weight to help you perform the thrust. After the thrust, release the pressure on the abdominal area by leaning back.

NOTE: If the thrust causes the casualty to vomit, turn his head to one side and clear the vomitus from his mouth. Then check the casualty for breathing. If additional thrusts are needed, reposition the casualty's head so his face is in the up position and his airway is open.)

Figure 5-6. Administering a modified abdominal thrust to an unconscious casualty.

(e) Repeat the modified abdominal thrusts until the obstruction has been expelled or until 5 thrusts have been administered.

(2) Chest thrust.

(a) Position yourself at the side of the casualty's chest.

(b) Locate the compression site by running two fingers along the lower edge of the rib cage toward the center of his chest until you come to the notch, placing the tip of your lower finger in the notch, placing your other hand next to and above the first finger, and placing the heel of your other hand next to and above the upper finger. The heel is now over the lower half of the sternum and covers the compression site. This is the same site used in administering CPR chest compressions (see figure 4-1). Make sure the long axis of your hand is parallel to the sternum.

(c) Place the heel of the other hand on top of the hand over the compression site. Make sure that the heel on bottom is not resting on any ribs. The fingers of the bottom hand should be straight. The fingers of the top hand should either be straight or be interlaced with the fingers of the first hand. Keep your fingers and palms off the casualty's chest.

(d) Lean forward so your shoulders are over your hands. Keep your arms straight.

(e) Thrust straight down on the lower half of the casualty's sternum (figure 5-7). Keep both arms straight and do not thrust to the right or left. The thrust should compress the sternum 1 1/2 to 2 inches in an adult casualty. Release the pressure by leaning back and away from the chest.

Figure 5-7. Administering a modified chest thrust to an unconscious casualty.

(f) Repeat the modified chest thrusts until the obstruction has been expelled or until 5 thrusts have been administered.

g. **Administer Two Ventilations.** After expelling the object or after performing 5 modified abdominal or chest thrusts, open the casualty's airway and attempt to administer two full breaths (paragraph 3-9).

(1) If your attempts to ventilate are successful, check for spontaneous breathing. If the casualty does not resume breathing on his own, perform rescue breathing or CPR as appropriate.

(2) If your attempts are not successful (chest does not rise), continue to perform finger sweeps and modified thrusts until you are able to ventilate the casualty or until you are told to stop your efforts by a qualified person.

5-7. MONITOR CASUALTY

Once the casualty begins to breathe normally, check and treat any other injuries. Evacuate the casualty to a medical treatment facility as soon as practical. If you cannot evacuate him at this time, stay with him until he regains consciousness and can take care of himself. The casualty should be examined by professional medical personnel. If the casualty's throat has been injured, it may swell and interfere with the casualty's breathing again.

Continue with Exercises

EXERCISES, LESSON 5

INSTRUCTIONS: Circle the letter of the response that BEST completes the statement or BEST answers the question. After you have completed all of the exercises, turn to "Solutions to Exercises" at the end of the lesson exercises and check your answers. For each exercise answered incorrectly, reread the material referenced after the solution.

1. Inhalation of vomitus and blood clots are more likely to be a cause of new airway blockage in a(n):

   a. Conscious casualty.

   b. Unconscious casualty.

2. The most common cause of airway blockage in an unconscious adult casualty is:

   a. Blood clots in the pharynx.

   b. Small objects, such as buttons, lodged in the trachea.

   c. Swallowed dentures.

   d. The casualty's tongue blocking the trachea.

3. A person who is choking and coughing weakly with high-pitched noises has a:

   a. Complete airway obstruction.

   b. Partial airway obstruction with good air exchange.

   c. Partial airway obstruction with poor air exchange.

4. A person who is choking, but coughing forcefully, has a:

   a. Complete airway obstruction.

   b. Partial airway obstruction with good air exchange.

   c. Partial airway obstruction with poor air exchange.

5. A person who is choking and cannot speak or cough has a:

    a. Complete airway obstruction.

    b. Partial airway obstruction with good air exchange.

    c. Partial airway obstruction with poor air exchange.

6. Which of the following is used to help an adult choking casualty with good air exchange?

    a. Backblows.

    b. Manual thrusts.

    c. Finger sweeps.

    d. b and c above.

    e. a, b, and c above.

    f. None of the above.

7. A casualty with an airway obstruction who has a partial blockage with poor air exchange is treated as though he had:

    a. Complete airway blockage.

    b. Partial blockage with good air exchange.

8. A choking casualty with poor air exchange is standing. You should:

    a. Administer abdominal or chest thrusts.

    b. Administer backblows.

    c. Administer finger sweeps.

    d. Encourage the casualty to keep calm and keep coughing.

    e. Have the casualty to lie down and elevate his feet.

9. Abdominal thrusts are usually preferred over chest thrusts when administering aid to a standing casualty with complete airway blockage. When are chest thrusts preferred?

    a. When you cannot reach around the casualty's midsection.

    b. When the casualty is noticeably pregnant.

    c. When the casualty has serious abdominal injuries.

    d. The chest thrust is the preferred method in all of the above situations.

10. When is a thrust delivered directly to the xiphoid process located at the bottom of the breastbone?

    a. When giving an abdominal thrust to a standing or sitting casualty.

    b. When giving a chest thrust to a standing or sitting casualty.

    c. When giving a chest thrust to an unconscious casualty.

    d. When giving a chest thrust to an unconscious casualty.

    e. None of the above. Force should never be applied directly to the xiphoid process.

11. A casualty has a blocked airway. You have delivered four abdominal thrusts with the casualty standing. The object has not yet been dislodged. What do you do next?

    a. Begin administering chest thrusts.

    b. Continue to administer abdominal thrusts.

    c. Have the casualty to lie down and administer modified abdominal thrusts.

    d. Have the casualty to lie down and administer chest thrusts.

12. When performing a chest thrust on a standing adult casualty who is choking, your hands should be:

    a. On the upper half of the casualty's sternum.

    b. On the bottom half of the casualty's sternum.

    c. Over the casualty's xiphoid process.

    d. Between the casualty's navel and rib cage.

13. You have expelled the airway obstruction from an unconscious casualty. The casualty is now conscious and breathing normally. Does the casualty need further examination?

    a. No, he has recovered fully.

    b. Only if he looses consciousness again.

    c. Yes, he may have damage to his throat.

14. When helping a casualty with an airway obstruction, finger sweeps are used:

    a. Only if the casualty is conscious.

    b. Only if the casualty is unconscious.

    c. Whether the casualty is conscious or unconscious.

15. You are about to administer abdominal thrusts to an adult casualty who is lying on his back. On what area of the casualty's body will you apply the force (place your hands)?

    a. Between the center of the sternum and the xiphoid process.

    b. Over the xiphoid process.

    c. Slightly above the navel and well below the xiphoid process.

    d. Over the navel.

16. A conscious casualty has a partial blockage with good air exchange. What should you do to help the casualty?

    a. Administer abdominal or chest thrusts.

    b. Administer backblows.

    c. Administer finger sweeps.

    d. Encourage the casualty to keep calm and keep coughing.

17. Which of the following describes a proper placement of the rescuer's hands for administering abdominal thrusts to a standing casualty?

    a. Make a fist with one hand, place the fist over the compression site, and wrap your other hand around the fist.

    b. Make a fist with one hand and place it over the compression site; then make a fist with your other hand and place it on top of the first fist.

    c. Interlock your fingers; then place your hands on the casualty's abdomen so that the compression site is located between the heels of your hands.

18. Which of the following describes a proper placement of the rescuer's hand for administering chest thrusts to an unconscious adult casualty.

    a. Make a fist with one hand, place the fist over the compression site, and wrap your other hand around the fist.

    b. Make a fist with one hand and place it over the compression site; then make a fist with your other hand and place it on top of the first fist.

    c. Place the heel of one hand over the compression site, place the heel of the other hand on the casualty's chest next to your first hand, and extend the fingers of both hands away from your body.

    d. Place the heel of one hand over the compression site, place your other hand on top of the first hand, and extend the fingers of both hands away from your body.

19. When administering chest thrusts to an unconscious casualty:

    a. Your shoulders should be directly over your hands and your arms should be bent slightly at the elbows.

    b. Your arms should be slightly bent at the elbows and at a 45 degree angle to the casualty's sternum.

    c. Your arms should be straight and at a 45 degree angle to the casualty's sternum.

    d. Your shoulders should be directly over your hands and your arms should be straight.

20. When performing chest thrusts on an unconscious adult, you should use enough force so that the casualty's sternum is pushed down about:

    a. 1/2 to 1 inch.

    b. 1 to 1 1/2 inches.

    c. 1 1/2 to 2 inches.

    d. 2 to 2 1/2 inches.

    e. 2 1/2 to 3 inches.

21. When administering a finger sweep, you should open the casualty's airway by:

    a. Grasping his tongue and lower jaw between the thumb and index finger of one hand and lifting.

    b. Pressing on the casualty's forehead until his neck is as hyperextended as possible.

    c. Forcing the casualty's mouth as wide open as possible.

    d. Lifting the casualty's neck until the neck is hyperextended and the mouth opens naturally.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 5

1. b (paras 5-1b, c)
2. d (para 5-1d)
3. c (para 5-3b)
4. b (para 5-3a)
5. a (para 5-3c)
6. f (para 5-4a)
7. a (para 5-5)
8. a (para 5-5c)
9. d (para 5-5c)
10. e (paras 5-5c(1)(b), c(2)(b), 5-6f(1)(b), f(2)(b))
11. b (para 5-5c(1)(e))
12. b (para 5-5c(2)(b))
13. c (para 5-7)
14. b (para 5-6c)
15. c (para 5-6f(1)(b))
16. d (para 5-4a)
17. a (para 5-5c(1))
18. d (para 5-6f(2))
19. d (para 5-6f(2)(d))
20. c (para 5-6f(2)(e)
21. a (para 5-6c(3))

End of Lesson 5

LESSON ASSIGNMENT

LESSON 6	Perform Cardiopulmonary Resuscitation on a Child or Infant.
TEXT ASSIGNMENT	Paragraphs 6-1 through 6-7.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

6-1. Identify the proper procedures for opening the airway of a child.

6-2. Identify the proper procedures for opening the airway of an infant.

6-3. Identify the proper procedures for performing mouth-to-mouth-and-nose rescue breathing.

6-4. Identify the proper procedures for performing one-rescuer CPR on a child.

6-5. Identify the proper procedures for performing one-rescuer CPR on an infant.

SUGGESTION After you have completed the text assignment, work the exercises at the end of this lesson before beginning the next lesson. These exercises will help you to achieve the lesson objectives.

LESSON 6

PERFORM CARDIOPULMONARY RESUSCITATION ON A CHILD OR INFANT

6-1. CHECK FOR RESPONSIVENESS

Rescue breathing and cardiopulmonary resuscitation efforts must be modified if the casualty is an infant (under 1 year of age) or a child (1 to 14 years of age, as defined by the onset of puberty, or presence of secondary sex characteristics.). As with an adult, your first efforts are to determine if the casualty is responsive (conscious). Tap the casualty on the shoulder or gently shake the casualty.

a. If the casualty responds, determine if the child or infant is in need of aid. Check for breathing problems, bleeding, fractures, other injuries, and illness.

b. If the casualty is not responsive (unconscious) or if the casualty is conscious but is not breathing adequately (poor air exchange or complete blockage), proceed to initiate rescue breathing and, if necessary, perform cardiopulmonary resuscitation.

6-2. OPEN THE AIRWAY

a. **Call For Help.** Call for assistance. You can do this at the same time you are positioning the casualty. If someone responds to your request for aid, send him to obtain professional medical help while you perform rescue breathing or CPR. Do not leave the casualty in order to obtain help.

b. **Position the Casualty.** Lay the casualty on his back on a firm, flat surface and out of danger. When moving an infant or child, always support the head and neck to prevent rolling and twisting. Position his head so that his face is up and his nose openings are straight up over his ear openings. This provides a slight head-tilt which will help to open the airway, but without hyper-extending the neck as does the head-tilt/chin-lift method used with adults. If an infant's head is tilted too far back, his trachea may collapse because the tracheal rings are not sufficiently developed.

c. **Open the Airway.** Open the casualty's airway using the modified head-tilt/chin-lift unless a head or spinal injury is suspected. If you suspect a spinal or head injury, use the modified jaw-thrust. The likelihood of a spinal or head injury is great if a child or infant is found at the scene of an accident.

(1) Modified head-tilt/chin-lift.

(a) Kneel at the side of the casualty.

(b) Place two or three fingers of your hand that is closest to the casualty's head on his forehead. In older children, apply enough pressure to tilt the head back slightly. In infants, the fingers keep the head in proper position.

(c) Lift the casualty's jaw using one or two fingers of your hand that is closest to his feet. Be sure that your fingers rest on the bony part of the chin and not on the soft part under the chin. The child's teeth (infant's gums) should be separated so that air can enter and leave his mouth. Do not use your thumb to perform the lift. As with an adult, the chin-lift moves the tongue forward so that it is not blocking the casualty's airway.

(2) Modified jaw-thrust.

(a) Position yourself above the casualty's head.

(b) Place one hand on each side of the casualty's head. Let your elbows rest on the surface on which the casualty is lying.

(c) Place the tips of two or three fingers of each hand under the angles of the casualty's jaw. (This is done on both sides of the casualty's jaw.)

(d) Lift the jaw upward gently with your fingertips (figure 6-1). The mouth should not be closed as this could prevent air from entering the casualty's airway.

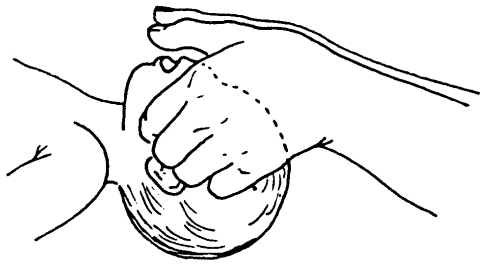


Figure 6-1. Performing a jaw -thrust on an infant.

d. **Check for Breathing.** Position your ear over the casualty's mouth and face his chest (figure 6-2).

(1) Look for the rising and falling of the chest. If the casualty is an infant, also observe the abdomen since infants use their abdominal muscles to assist in breathing.

(2) Listen for the sound of breathing (inhalation and exhalation).

(3) Feel for air movement on the side of your face caused by the casualty exhaling.

Figure 6-2. Checking an infant for breathing.

e. **Evaluate Your Findings.**

(1) If your check shows that the casualty is breathing, maintain his airway and examine him for injuries. Check on the casualty's breathing periodically. Be prepared to administer rescue breathing or CPR should the casualty stop breathing.

(2) If your check shows that the casualty is not breathing, begin rescue breathing (paragraph 6-3) immediately.

6-3. ADMINISTER TWO VENTILATIONS

If the child or infant is not breathing, administer two ventilations. If you are able to seal your mouth over both the casualty's mouth and nose at the same time, administer ventilations using the mouth-to-mouth-and-nose method. If you are not able to seal your mouth over both the mouth and nose, administer mouth-to-mouth or mouth-to-nose ventilations as described in paragraph 3-9. Administer smaller breaths with a child or infant since you do not need to blow as much air into his lungs for them to expand fully. The mouth-to-mouth-and-nose method is described in the following paragraphs.

a. Maintain the airway (modified head-tilt/chin lift or modified jaw-thrust).

b. Take a breath. Do not take a deep breath since you will not need to blow much air to inflate the casualty's smaller lungs.

c. Seal your mouth over the casualty's mouth and nose. Make sure that your mouth forms an air tight seal so that air will not escape when you blow air into his mouth and nose.

d. Blow a small puff of air (only enough to make his chest rise) into the casualty's mouth and nose. Observe the chest out of the corner of your eye as you administer the breath.

e. After blowing into the casualty's mouth and nose, break the seal over his face and allow air to escape. His chest should fall somewhat as air escapes after you break the seal. You may be able to hear or feel the exhaled breath also.

f. Take another breath, seal your mouth over the casualty's mouth and nose again, and administer a second puff of air. It should take about one second to administer each breath.

6-4. EVALUATE THE EFFECTIVENESS OF THE VENTILATIONS

a. If the casualty is now breathing on his own, maintain his airway and examine the casualty for injuries. Be prepared to administer rescue breathing or CPR should the casualty stop breathing again.

b. If your ventilations made the casualty's chest rise but the casualty is not breathing on his own, check his pulse (paragraph 6-5).

c. If your ventilations did not make the casualty's chest rise, reposition the casualty's head and administer two puffs of air again.

(1) If your second attempt is successful, check the casualty's pulse (paragraph 6-5).

(2) If your second attempt still does not cause the casualty's chest to rise, the casualty probably has something blocking his airway. Remove the obstruction using the procedures given in lesson 7.

6-5. CHECK FOR PULSE

If the casualty is a child, check for a pulse at the carotid artery (same location as in an adult). If the casualty is an infant, however, you may have trouble locating the carotid pulse due to the casualty's short, chubby neck. Therefore, the brachial artery is usually used to feel for an infant's pulse. The brachial pulse is taken on the inside of the casualty's inner arm between the elbow and the shoulder (figure 6-3). Use only two fingers (no thumb) to gently press on the artery. The check should take between 5 and 10 seconds. Continue to monitor the casualty for signs of spontaneous breathing as you check for a pulse.

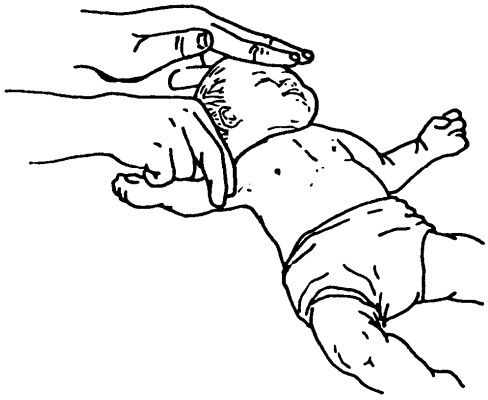


Figure 6-3. Checking an infant for a brachial pulse.

a. If the casualty has an adequate pulse and has resumed breathing on his own, begin checking for other injuries. Bradycardia is a common terminal rhythm in infants and children; you should not wait for the absence of a pulse to begin chest compressions. If a child has a heart rate less than 60 beats per minute and is showing signs of poor systemic perfusion, you should begin chest compressions. Keep the airway open and monitor his breathing. Administer rescue breathing or CPR if he stops breathing. Evacuate the casualty to a medical treatment facility as soon as possible.

b. If you detect a pulse but the casualty still is not breathing, continue to administer ventilations.

(1) Child. Administer ventilations at the rate of one ventilation every 3 to 5 seconds (12 to 20 ventilations per minute).

(2) Infant. Administer ventilations at the rate of one ventilation every 3 to 5 seconds (12 to 20 ventilations per minute).

c. If you do not detect a pulse and no one has responded to your previous call for help, call for help again. If a telephone or radio unit is readily available, use it to summon additional medical help. In the pediatric patient, it is important to phone “fast” versus phoning “first” in the adult. Pediatric cardiac arrest is usually secondary to respiratory arrest, phoning “fast” may deliver adequate oxygen fast enough to the heart to prevent permanent damage. Then begin administering CPR (paragraph 6-6).

6-6. ADMINISTER CARDIOPULMONARY RESUSCITATION

a. **Locate Compression Site.**

(1) Child. The chest compression site on a child is located on top of the infant's sternum just below an imaginary line connecting the nipples (figure 6-4).

(2) Infant. The chest landmarks on an infant are the same as for the child.

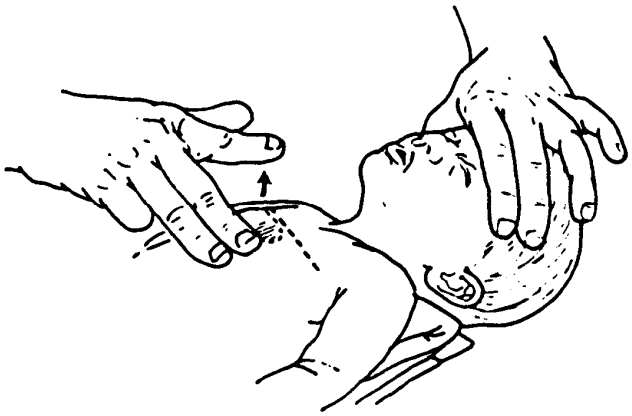


Figure 6-4. Locating the compression site on an infant.

b. **Administer Thirty Chest Compressions.**

(1) Child.

(a) Use one or two hands to administer chest compressions to a child, depending on the size of the child. The 30:2 compression ratio will be used for one rescuer CPR in the child and infant. For two rescuers the ratio will be 15:2. Press straight down on the heel of your hand over the compression site so that the sternum is depressed 1/3 to 1/2 the total depth of the chest (1 to 1 1/2 inches).

(b) Repeat the compressions at a rate of 100 per minute.

(c) Allow the chest to return to its resting position after each thrust, but do not remove your heel from the compression site. If the compression site is lost, repeat the location procedures before administering more chest thrusts. The thrust and the relaxation parts of the compression should be of equal duration.

(2) Infant.

(a) The infant should be lying on a firm, flat surface before CPR is begun. If needed, you can provide a firm support by slipping your nondominant hand under his back and using your dominant hand to administer compressions.

(b) Chest compressions on an infant should be administered with the tips of the middle and ring fingers. Press straight down so that the sternum is depressed from 1/3 to 1/2 the total depth of the chest (1/2 to 1 inch).

(c) Repeat the compressions at a rate of at least 100 per minute.

(d) Compressions should be smooth, not jerky. Allow the chest to return to its resting position after each thrust, but do not remove your fingertips from the compression site. The thrust and the relaxation parts of the compression should be of equal duration.

c. **Administer Two Breaths.** After administering the thirtieth compression, administer two slow ventilations. Observe the casualty's chest out of the corner of your eye. Blow just enough air into the casualty's airway to expand his lungs fully.

(1) If possible, seal your mouth over the casualty's mouth and nose and administer mouth-to-mouth-and-nose resuscitation.

(2) If the casualty is an infant, do not remove your fingers from the compression site on his chest. Use only one hand to maintain the infant's airway (fingers on the forehead if the modified head-tilt/chin-lift is used or fingers under one angle of his jaw if the jaw-thrust is used).

d. **Perform Four Additional Cardiopulmonary Resuscitation Cycles.** Perform four more cycles of 30 compressions and two ventilations.

(1) If the casualty is a child, you should be able to visually relocate the compression site after each set of ventilations without having to repeat the procedures listed in paragraph 4-1d.

(2) If the casualty is an infant, your fingers should still be on the compression site, thus eliminating the need to relocate the site.

e. **Check Pulse.** After five cycles, check the casualty's pulse again. The check should not take longer than 5 seconds. As you check the pulse, also check for spontaneous breathing.

(1) If the casualty has a pulse and he has resumed breathing on his own, stop administering CPR and begin checking for other injuries. Keep the airway open and check his breathing every few minutes if he does not regain consciousness. Resume administering rescue breathing or CPR if he stops breathing.

(2) If the casualty has a pulse but has not resumed breathing on his own, proceed to administer rescue breathing. Recheck the casualty's pulse every few minutes. If you find the casualty's pulse to be absent, resume administering CPR.

(a) For a child, administer ventilations at the rate of one ventilation every 3 to 5 seconds (12 to 20 ventilations per minute).

(b) For an infant, administer ventilations at the rate of one ventilation every 3 to 5 seconds (12 to 20 ventilations per minute).

(3) If the casualty does not have a pulse, continue to administer thirty chest compressions followed by two breaths. Recheck the pulse again every few minutes. Continue administering CPR until one of the following occurs:

(a) The casualty's heart resumes beating on its own. (If this happens, continue rescue breathing.)

(b) The casualty's heart resumes beating on its own and he also resumes breathing on his own. (If this happens, look for injuries.)

(c) You are relieved by a physician or other medical personnel. (If this happens, provide information on the casualty and follow instructions.)

6-7 EVACUATE THE CASUALTY

Evacuate the casualty to a medical treatment facility as soon as possible. Continue administering CPR or rescue breathing en route if needed. If the casualty is breathing on his own, continue to observe him and be prepared to resume rescue breathing or CPR should it become necessary.

Continue with Exercises

EXERCISES, LESSON 6

INSTRUCTIONS: Circle the letter of the response that BEST completes the statement or BEST answers the question. After you have completed all of the exercises, turn to "Solutions to Exercises" at the end of the lesson exercises and check your answers. For each exercise that you answered incorrectly, reread the material referenced after the solution.

1. The term "infant" is used to describe a person whose age is under:

   a. 6 months.

   b. 12 months.

   c. 2 years.

   d. 8 years.

2. You have found a child who appears to be unconscious. Which of the following should be your first action?

   a. Administer rescue breathing.

   b. Call for help.

   c. Check for pulse.

   d. Check for responsiveness.

3. You are preparing to administer rescue breathing to a child who does not appear to have any spinal or head injuries. You should open the casualty's airway using a modified:

   a. Head-tilt/chin-lift.

   b. Head-tilt/neck-lift.

   c. Jaw-thrust.

   d. Tongue-jaw lift.

4. Which of the following correctly states a difference between opening the airway of an infant and opening the airway of an adult?

    a. The adult casualty is placed flat on his back whereas the infant casualty is places on his stomach.

    b. The adult casualty is placed on his stomach whereas the infant casualty is placed flat on his back.

    c. The head is not tilted as far back with an infant casualty as it is with an adult casualty.

    d. The head is not tilted as far back with an adult casualty as it is with an infant casualty.

5. The term "child" is used to describe a person whose age is under:

    a. 1 year.

    b. 8 year.

    c. 12 years.

    d. 14 years.

6. When performing the modified jaw-thrust technique of opening the airway on a child, the chin is lifted using:

    a. Two or three fingers placed under the bony part of the chin.

    b. Two or three fingers placed under the tip of the chin and a thumb hooked inside the casualty's mouth.

    c. A thumb hooked under the chin.

    d. Two or three fingers placed under the angles of the casualty's jaw.

7. You are administering rescue breathing (no chest compressions) to a child. How many ventilations should you administer in 1 minute?

   a. 8 to 12

   b. 15 to 30.

   c. 12 to 20.

   d. 20 to 30.

8. Which of the following correctly states a difference between checking for breathing in an infant and checking for breathing in an adult.

   a. With an infant, you do not feel for air flow on your cheek.

   b. With an infant, you do not need to check for signs of breathing.

   c. With an infant, you listen for sounds of breathing by placing your ear over the center of the infant's right lung.

   d. With an infant, you look for a rising and falling of the abdomen in addition to the chest.

9. You are administering rescue breathing to a small child. How does your actions differ from administering rescue breathing to an adult.

   a. There is no difference.

   b. You blow into both the casualty's nose and mouth at the same time if possible.

   c. You do not maintain the airway while you perform rescue breathing.

   d. You do not need to worry about airway obstructions since your larger lungs can overcome resistance from an obstruction.

10. Which of the following statements is true?

    a. You find the compression site for CPR on an infant in the same manner as for an adult.

    b. You find the compression site for CPR on a child in the same manner as for an adult.

    c. You find the compression site for CPR on an infant in the same manner as for a child.

11. Which of the following describes a one-rescuer CPR cycle for a child?

    a. Thirty compressions followed by two ventilations.

    b. Five chest compressions followed by two ventilations.

    c. Fifteen chest compressions followed by one ventilation.

    d. Fifteen chest compressions followed by two ventilations.

12. You are going to administer CPR chest compressions to an infant. The compression should push the breastbone down about:

    a. 1/2 to 1 inch.

    b. 1 to 1 1/2 inches.

    c. 1 1/2 to 2 inches.

    d. 2 to 2 1/2 inches.

13. When performing CPR on a child, you should perform compressions at a rate of:

    a. 45 to 60 chest compressions per minute.

    b. 60 to 80 chest compressions per minute.

    c. 100 chest compressions per minute.

    d. 100 to 120 chest compressions per minute.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 6

1. b (para 6-1)
2. d (para 6-1)
3. a (para 6-2c)
4. c (paras 6-2b, c(1)(b))
5. d (para 6-1)
6. d (paras 6-2c(2)(c), (d))
7. c (para 6-5b(1))
8. d (para 6-2d(1))
9. b (para 6-3)
10. c (para 6-6a(1))
11. a (paras 6-6b, c, d)
12. a (para 6-6b(2)(b))
13. c (para 6-6b(1)(b))

End of Lesson 6

LESSON ASSIGNMENT

LESSON 7	Remove an Airway Obstruction in a Child or Infant.
TEXT ASSIGNMENT	Paragraphs 7-1 through 7-4.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

7-1. Identify the proper procedures for removing an airway obstruction in a conscious child.

7-2. Identify the proper procedures for removing an airway obstruction in an unconscious child.

7-3. Identify the proper procedures for removing an airway obstruction in a conscious an infant.

7-4. Identify the proper procedures for removing an airway obstruction in an unconscious infant.

SUGGESTION After you have completed the text assignment, work the exercises at the end of this lesson before beginning the examination. These exercises will help you to achieve the lesson objectives.

LESSON 7

REMOVE AN AIRWAY OBSTRUCTION IN A CHILD OR INFANT

7-1. REMOVE UPPER AIRWAY OBSTRUCTION IN A CONSCIOUS CHILD

a. **Good Air Exchange.** If the child is coughing, encourage him to continue coughing as long as he is coughing with enough force to expel the object.

b. **Poor Air Exchange or Complete Blockage.** If the child's coughs are weak or nonexistent or if he has difficulty breathing accompanied by a harsh, high pitched noise when inhaling (stridor), administer abdominal thrusts to expel the obstruction. As you prepare to administer the thrusts, call for help, but do not delay performing the thrusts to seek help.

(1) If the child is sitting or standing, perform abdominal thrusts using the same procedures as for an adult (paragraph 5-5). Continue administering thrusts until the obstruction is expelled or until the child loses consciousness. If the child loses consciousness, lower the child to the ground and administer modified abdominal thrusts as described in paragraph 7-2.

(2) If the child is choking with poor or no air exchange and is lying down, position the child flat on his back on a firm surface and administer modified abdominal thrusts as described in paragraph 7-2.

7-2. REMOVE UPPER AIRWAY OBSTRUCTION IN AN UNCONSCIOUS CHILD

The steps given below assume the child is conscious and lying down [paragraph 7-1b(2)] or lost consciousness while you were administering abdominal thrusts [paragraph 7-1b(1)]. If you discovered an airway obstruction while performing rescue breathing [paragraph 6-4c(2)], you will have already performed the steps given in paragraphs a through c below.

a. Call for help if you have not done so or if help has not arrived.

b. Lay the child on his back on a firm, flat surface, open his airway, and check for breathing (paragraph 6-2).

c. If the child is not breathing, attempt to administer two ventilations (paragraph 6-3). If the airway is blocked, reposition the head and attempt to administer two ventilations again.

d. If the airway is still blocked, administer modified abdominal thrusts to expel the object.

NOTE: Abdominal thrusts are preferred for clearing the airway of a child. If abdominal thrusts cannot be administered due to abdominal injuries, perform chest thrusts by locating the compression site (paragraph 4-1d) and administering thrusts with the heel of one hand sufficient to depress the lower half of the sternum 1 to 1 1/2 inches. Make each thrust separate and distinct.]

(1) Abdominal thrust--large child. If the child is large, administer abdominal thrusts using the same procedures as for an adult [paragraph 5-6f(1)].

(2) Abdominal thrust--small child.

(a) If the child is small, position yourself at the child's side. Striding the casualty's thighs is not recommended for small children. If the child is on a table, you may prefer to stand at his feet and deliver the thrusts.

(b) Place the heel of your hand that is closest to the child's feet on his abdomen. The heel should be on the midline slightly above the navel and well below the rib cage and xiphoid process. Turn your hand so your fingers are straight out and pointing toward the child's head.

(c) Place the heel of your hand on top of the first hand.

(d) Administer quick, but gentle, inward and upward thrusts.

e. If the obstruction has not been expelled after five thrusts, open his mouth using jaw-tongue lift [paragraph 5-6c(3)] and look for the obstruction. If you see the obstruction, perform a finger sweep [paragraphs 5-6c(5), (6), and (7)] and remove the obstruction. Do not perform a blind finger sweep since you may push the obstruction deeper into the child's throat.

f. Attempt to administer two ventilations again (paragraph 6-3). If the airway is still blocked, perform up to five abdominal thrusts and visually check for the obstruction again. Once the obstruction is removed, perform rescue breathing or CPR (Lesson 6) as needed if the child does not begin breathing again on his own.

7-3. REMOVE UPPER AIRWAY OBSTRUCTION IN A CONSCIOUS INFANT

If a head or spinal injury is suspected, place the infant on a firm surface and administer chest thrusts and finger sweeps (no backblows) as needed. If a head or spinal injury is not suspected (for example, the infant is choking on something he just swallowed), use the procedures given below to remove the obstruction. The rescuer should be in a kneeling or sitting position. (Note that backblows are administered to infants, but not to children or adults.)

a. **Call for Help**. Call for help, but do not leave the casualty or delay administering chest thrusts in order to seek help. You may need someone to take you and the infant to a medical facility while you continue to perform lifesaving measures.

b. **Position Infant for Backblows.**

(1) Small infant. Roll the infant's body lengthwise over your arm so the infant is straddling your forearm with his rear toward you and his back up as shown in figure 7-1. Support the infant's head with the thumb and fingers of your hand. Rest your forearm on your thigh to provide support. Be sure the infant's head is lower than the trunk of his body.

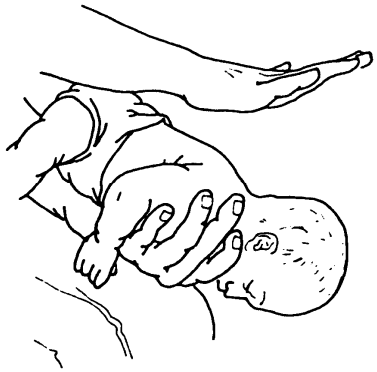


Figure 7-1. Administering backblows to a small infant.

(2) Large infant. If the infant is too large to straddle your arm, lay the casualty's body across your thighs with his head lower than the trunk of his body. Position the arm that will not be used to administer backblows under the infant's body so that the hand supports the infant's head and neck. The forearm under the infant's chest will provide a firm surface for the backblows.

c. **Administer Backblows.** Administer five glancing backblows (figure 7-1). A backblow is administered by striking the infant on the spine between his shoulder blades with the heel of your free hand. The five blows should be delivered within 5 seconds.

d. **Position Infant for Chest Thrusts.** Chest thrusts are used instead of abdominal thrust because the force of abdominal thrusts could injury the abdominal organs of an infant.

(1) Small infant. Place your free arm over the infant's back with your arm over his spine and your hand resting on the back of his head. Turn the infant over so he is now positioned with his face up and you are supporting the back of his head in the palm of your hand. Rest your forearm on your thigh. Make sure the infant's head is lower than his trunk. The forearm under the infant's back will provide the firm surface needed for the chest thrusts.

(2) Large infant. If the infant is too large to straddle your arm, turn the infant over and lay his body across your thighs with his head lower than the trunk of his body. Put your arm (the arm not being used to deliver chest thrusts) under the infant's head and neck. The forearm under the infant's back will provide a firm surface for the chest thrusts.

e. **Administer Chest Thrusts.** Chest thrusts are used rather than abdominal thrusts due to the danger of injury to abdominal organs from abdominal thrusts. The chest thrusts are performed in the same manner as are CPR chest compressions for infants (paragraph 6-6) except the thrusts are delivered at a somewhat slower rate.

(1) Draw an imaginary line on the casualty's chest connecting his nipples.

(2) Place the index finger of your free hand just under the imaginary line on top of the infant's sternum.

(3) Place your middle and ring fingers on the sternum so that they are below (closer to the infant's feet than) your index finger.

(4) Lift your index finger from the infant's sternum.

(5) Press straight down with the tips of the middle and ring fingers so the sternum is depressed 1/2 to 1 inch.

(6) Relax pressure without removing your fingertips from the compression site and allow the sternum to return to its normal position.

(7) Repeat the chest thrusts until a total of five chest thrusts have been administered or the object has been expelled.

f. **Repeat Backblows and Chest Thrusts.** Repeat the series of five backblows and five chest thrusts until the obstruction is expelled or until the infant looses consciousness.

(1) If the obstruction is expelled, check the infant for breathing. Administer rescue breathing or CPR (lesson 6) as needed if the infant does not resume breathing on his own.

(2) If the infant loses consciousness, use the procedures given in paragraph 7-4.

7-4. REMOVE UPPER AIRWAY OBSTRUCTION IN AN UNCONSCIOUS INFANT

The steps given below assume the infant lost consciousness while you were administering rescue thrusts [paragraph 7-3f(2)] or you discovered an airway obstruction while performing rescue breathing [paragraph 6-4c(2)]. If a head or spinal injury is suspected, administer chest thrusts and finger sweeps, but do not administer backblows. The procedures given in the following paragraphs assume that no head or spinal injury is present.

a. **Call for Help.** Call for help if you have not done so and determine unresponsiveness.

b. **Position Infant for Foreign Body Check.**

(1) Small infant. Turn the infant face up with your arm under the infant's back so your hand is supporting the back of his head and your forearm is under his spine. Rest your forearm on your thigh so the infant's head is lower than his trunk.

(2) Large infant. If the infant is too large to straddle your arm, lay the casualty's body across your thighs with his face up and his head lower than the trunk of his body. Position the arm that will not be used to remove the object under the infant's body with the hand supporting the infant's head and neck.

c. **Open the Infant's Mouth.** Open the infant's mouth using a tongue-jaw lift technique.

(1) Place the thumb of one hand (the hand not supporting his head) into his mouth and over his tongue.

(2) Wrap the fingers of the hand around his lower jaw.

(3) Lift the jaw and tongue forward.

d. **Remove Any Visible Foreign Matter.** If you see any foreign matter in the infant's mouth or throat, remove the obstruction with a finger sweep (paragraph 5-6c). Do not perform a blind finger sweep since this action could force the obstruction deeper into the infant's throat.

e. **Check for Breathing.** Tilt the infant's head back slightly and lift the infant's chin to open the airway. Look, listen, and feel for signs of breathing (chest or abdomen rising and falling, sounds of breathing, exhaled air blowing on cheek).

(1) If spontaneous breathing occurs, maintain the airway and check for other injuries.

(2) If spontaneous breathing does not occur, attempt to administer ventilations.

f. **Administer Two Ventilations.** If the infant is not breathing on his own, administer two ventilations using the mouth-to-mouth-and-nose method. Even if the obstruction has not been removed, your efforts may have caused it to shift enough so rescue breathing can now be administered.

(1) Maintain the airway by lifting the infant's chin with the free hand. Do not hyperextend the neck.

(2) Take a breath. (Do not take a deep breath since you will not need to blow much air into the infant's smaller lungs.)

(3) Place your mouth over the infant's mouth and nose. Make sure that your mouth forms an airtight seal so that air will not escape when you blow air into his mouth and nose.

(4) Blow a small puff of air (only enough to make the chest rise) into the infant's mouth and nose. Observe the chest out of the corner of your eye as you administer the breath.

(5) After blowing into the infant's mouth and nose, break the seal over his face and allow air to escape. His chest should fall somewhat as air escapes after you break the seal. You may be able to hear or feel the exhaled breath.

(6) Take another breath, seal your mouth over the infant's mouth and nose again, and administer a second puff of air. It should take 3 to 5 seconds to administer both breaths.

g. **Evaluate Your Efforts.**

(1) If your ventilations were successful (chest rose and fell), check the infant's pulse (paragraph 6-5).

(a) If the pulse is absent, administer CPR (paragraph 6-6).

(b) If a pulse is present, administer ventilations at the rate of one ventilation every 3 seconds (20 ventilations per minute). Check the pulse again every few minutes. Also check for spontaneous breathing when you check the pulse. If the pulse is absent, administer CPR.

(c) Continue your efforts until the infant is breathing spontaneously or until you are relieved by a physician or other medical authority. If possible, evacuate the casualty to a medical treatment facility as you perform rescue breathing/CPR.

(2) If your ventilations were not successful (air did not go in and the chest did not rise), perform backblows (if no spinal or head injury), chest thrusts, finger sweeps (when appropriate), and ventilations as given in the following paragraphs until the obstruction is removed.

h. **Call for Help.** Call for help again. If a second rescuer is available, have him seek medical assistance.

i. **Position Infant for Backblows.** Position the infant for backblows using the procedures given in paragraph 7-3b(1) if the casualty is a small infant and in paragraph 7-3b(2) if the casualty is a large infant.

j. **Administer Backblows.** Administer five backblows by striking the infant on the spine between his shoulder blades with the heel of your free hand. The five blows should be delivered within 3 to 5 seconds.

k. **Position Infant for Chest Thrusts.** Position the infant for chest thrusts using the procedures given in paragraph 7-3d(1) if the casualty is a small infant and in paragraph 7-3d(2) if the casualty is a large infant.

l. **Administer Chest Thrusts.** Perform chest thrusts in the manner described in paragraph 7-3e. Continue until the obstruction has been expelled or until you have administered five chest thrusts.

m. **Continue Efforts to Expel Obstruction.** If the chest thrusts did not expel the object, continue your efforts until the object is expelled or you are ordered to stop by a medical authority. If possible, evacuate the casualty as you continue your efforts.

(1) Open the infant's mouth using a tongue-jaw lift technique and remove any visible foreign matter with a finger sweep.

(2) Open the infant's airway and check for signs of breathing. If spontaneous breathing occurs, maintain the airway.

(3) If the infant does not resume breathing on his own, administer two ventilations using the mouth-to-mouth-and-nose method.

(a) If your ventilations were successful, check the infant's pulse. If a pulse is absent, administer CPR (paragraph 6-6). If a pulse is present, administer rescue breathing at the rate of one ventilation every 3 seconds and recheck the pulse again every few minutes.

(b) If your ventilations were not successful (air did not go in and chest did not rise), continue with your efforts to expel the obstruction.

(4) If your ventilations were not successful, position the infant for backblows and administer five back blows.

(5) If the backblows did not expel the obstruction, position the infant for chest thrusts and administer five chest thrusts.

(6) If the chest thrusts did not expel the obstruction, continue with your efforts to expel the obstruction [paragraph 7-4m(1) through (6)].

NOTE: Public education is vital to alleviate fear of risk of disease transmission during CPR. Use barriers as recommended by the Centers for Disease Control and the Occupational Safety and Health Administration.

Continue with Exercises

EXERCISES, LESSON 7

INSTRUCTIONS: Circle the letter of the response that BEST completes the statement or BEST answers the question. After you have completed all of the exercises, turn to "Solutions to Exercises" at the end of the lesson exercises and check your answers. For each exercise that you answered incorrectly, reread the material referenced after the solution.

1. A choking child has harsh, high-pitched noises while attempting to breathe. You should:

   a. Administer manual thrusts to remove the obstruction.

   b. Encourage him to keep coughing.

2. Backblows can be administered to a choking casualty if the casualty is a(n):

   a. Adult.

   b. Child.

   c. Infant.

   d. Male.

   e. Child or an infant.

3. _____ thrusts are preferred for clearing the airway of a child.

   a. Abdominal

   b. Chest.

4. You have administered five abdominal thrusts in an unsuccessful effort to remove an airway obstruction in an unconscious child. What should you do next?

   a. Administer a blind finger sweep.

   b. Administer abdominal thrusts.

   c. Administer backblows.

   d. Perform a visual check for the obstruction.

5. When administering backblows to an infant, the infant is positioned:

   a. Face down on the floor.

   b. Face down on the rescuer's forearm.

   c. Face up on the floor.

   d. Face up on the rescuer's forearm.

6. _____ thrusts are used to clear the airway of an infant.

   a. Abdominal.

   b. Chest.

7. A choking infant has head injuries from an accident. How will these injuries change the way you attempt to remove the airway obstruction?

   a. You will perform abdominal thrusts instead of chest thrusts.

   b. You will perform chest thrusts instead of abdominal thrusts.

   c. You will not perform backblows.

   d. You will not perform finger sweeps.

8. You are going to administer chest thrusts in an effort to expel an obstruction in an infant's airway. When you press down with your fingertips, the sternum should be depressed about:

   a. 1/4 inch.

   b. 1/2 inch to 1 inch.

   c. 1 inch to 1 1/2 inches.

   d. 2 inches to 2 1/2 inches.

9. You are going to administer chest thrusts in an effort to expel an obstruction in an infant's airway. The fingertips should be placed:

   a. Directly over the casualty's left nipple.

   b. Directly over the casualty's right nipple.

   c. On the sternum slightly above an imaginary line drawn between the casualty's nipples.

   d. On the sternum slightly below an imaginary line drawn between the casualty's nipples.

10. You have unsuccessfully attempted to ventilate an unconscious infant. You should now:

    a. Perform a blind finger sweep.

    b. Administer five chest thrusts followed by five abdominal thrusts.

    c. Administer five backblows followed by five abdominal thrusts.

    d. Administer five backblows followed by five chest thrusts.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 7

1. a (para 7-1b)
2. c (para 7-3)
3. a (paras 7-1b, 7-2d Note)
4. d (para 7-2e)
5. b (paras 7-3b, 7-4i, fig 7-1)
6. b (paras 7-3d, 7-4l)
7. c (paras 7-3, 7-4)
8. b (paras 7-3e(5), 7-4l)
9. d (paras 7-3e, 7-4l)
10. d (paras 7-4g(2), j, k)

End of Lesson 7

LESSON ASSIGNMENT

LESSON 8	Administer CPR and Automated External Defibrillation (AED) on an Unconscious Casualty with Suspected Cardiac Arrest.
TEXT ASSIGNMENT	Paragraphs 8-1 to 8-5.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

8-1. Identify the proper indications for early defibrillation

.

8-2. Identify the proper procedures for integrating the AED and CPR.

8-3. Identify the proper procedures for caring for a patient after the AED delivers its shock.

8-4. Identify the proper procedures for cardiac arrest during patient transport.

8-5 Identify the proper procedures for maintaining an AED.

SUGGESTION After you have completed the text assignment, work the exercises at the end of this lesson before beginning the next lesson. These exercises will help you to achieve the lesson objectives.

LESSON 8

ADMINISTER CARDIOPULMONARY RESUSCITATION AND AUTOMATED EXTERNAL DEFIBRILLATION ON AN UNCONSCIOUS CASUALTY WITH SUSPECTED CARDIAC ARREST

8-1. INDICATIONS FOR EARLY DEFIBRILLATION

Very few patients who experience sudden cardiac arrest outside of a hospital survive unless a rapid sequence of events takes place. The chain of survival (figure 8-1) is a way of describing the ideal sequence of events that can take place when such an arrest occurs.

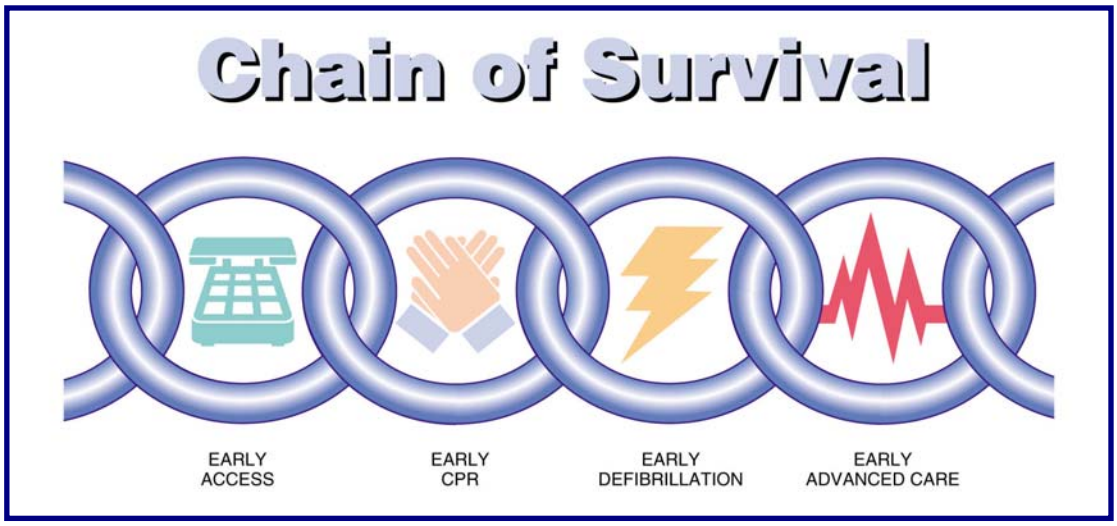


Figure 8-1. Cardiopulmonary resuscitation chain of survival.

a. Recognition of early warning signs and immediate activation of emergency medical support. Few patients benefit from defibrillation when more than 10 minutes elapse before administration of the first shock and/or CPR is not performed in the first 2 to 3 minutes.

b. Immediate bystander CPR. Cardiopulmonary resuscitation helps prolong the time during which defibrillation can be effective.

c. Early defibrillation. This may be the most important link in the chain of survival. Rapid defibrillation has successfully resuscitated many patients with cardiac arrest from ventricular fibrillation. Figure 8-2 shows how an automated external defibrillator (AED) works.

d. Early advanced cardiac life support.

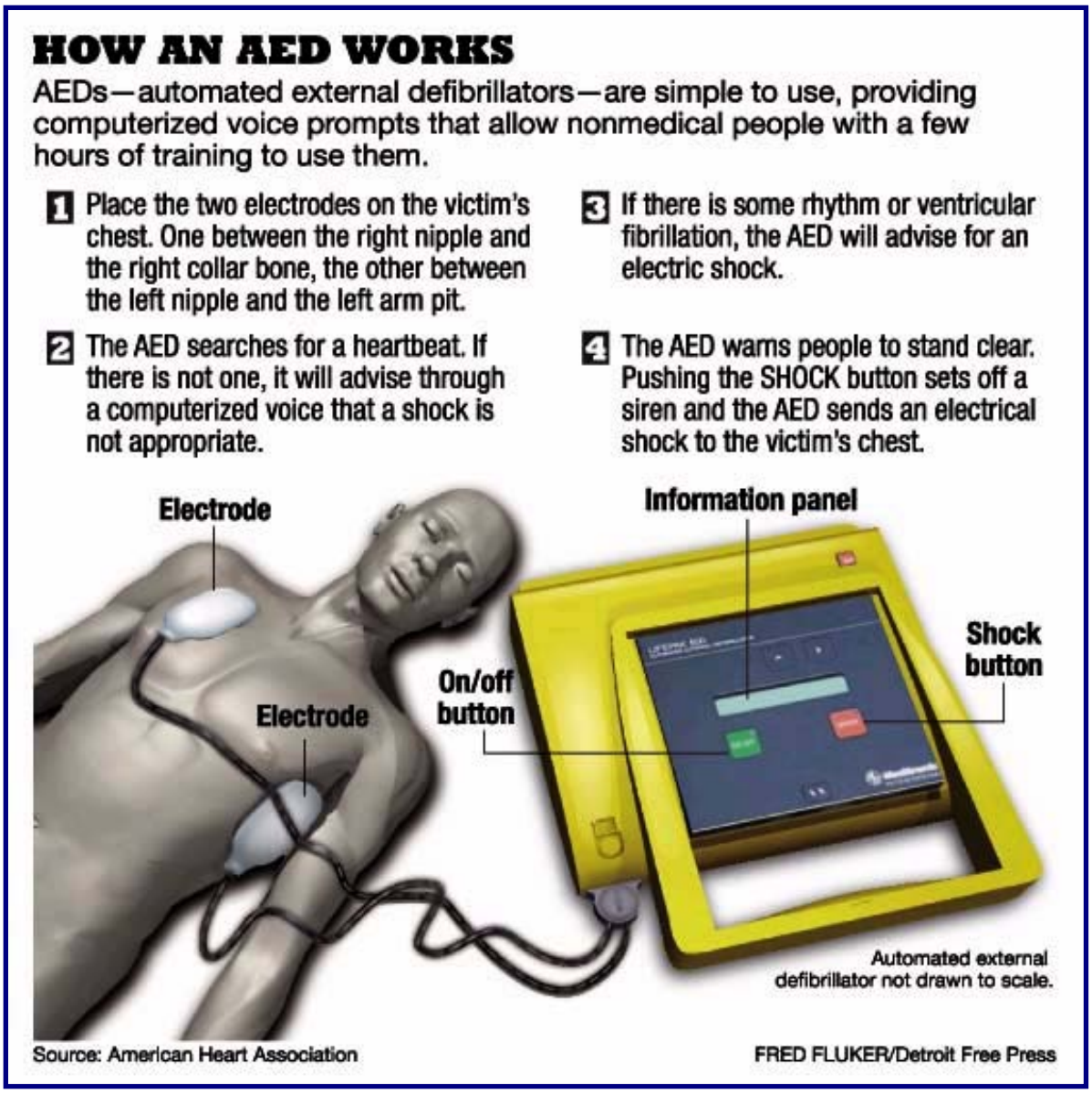

HOW AN AED WORKS
AEDs—automated external defibrillators—are simple to use, providing computerized voice prompts that allow nonmedical people with a few hours of training to use them.
1 Place the two electrodes on the victim's chest. One between the right nipple and the right collar bone, the other between the left nipple and the left arm pit.
2 The AED searches for a heartbeat. If there is not one, it will advise through a computerized voice that a shock is not appropriate.
3 If there is some rhythm or ventricular fibrillation, the AED will advise for an electric shock.
4 The AED warns people to stand clear. Pushing the SHOCK button sets off a siren and the AED sends an electrical shock to the victim's chest.
Electrode
Electrode
Information panel
On/off button
Shock button
Automated external defibrillator not drawn to scale.
Source: American Heart Association
FRED FLUKER/Detroit Free Press

Figure 8-2. How the AED works.

8-2. PROCEDURES FOR INTEGRATING THE AUTOMATED EXTERNAL DEFIBRILLATOR AND CARDIOPULMONARY RESUSCITATION

It is important to know how to integrate the AED into the CPR sequence. If an AED is immediately available, it should be attached to the patient and treatment should be initiated. Delaying CPR at this point is justified because the defibrillation sequence will be started right away. If the AED is not immediately available or if CPR is already in progress, follow these steps.

a. Arrive on the scene and perform your initial assessment. Assess the patient for responsiveness. If the patient is responsive, do not apply the AED. A conscious patient may be in ventricular tachycardia, which is recognized as a shockable rhythm by the AED. It is not advised to shock a conscious patient with the AED.

b. Stop CPR.

c. Verify pulselessness and apnea. Check for “adequate” breathing and a pulse.

d. Resume CPR.

e. Prepare the AED.

f. Turn on the machine.

g. Remove the clothing from the patient's chest area and apply AED pads.

(1) Apply the two pads to the patients’ bare chest (figure 8-3). Apply one pad to the right of the sternum just below the clavicle. Apply the other pad to the left part of the chest with the top of the pad 2 to 3 inches below the armpit.

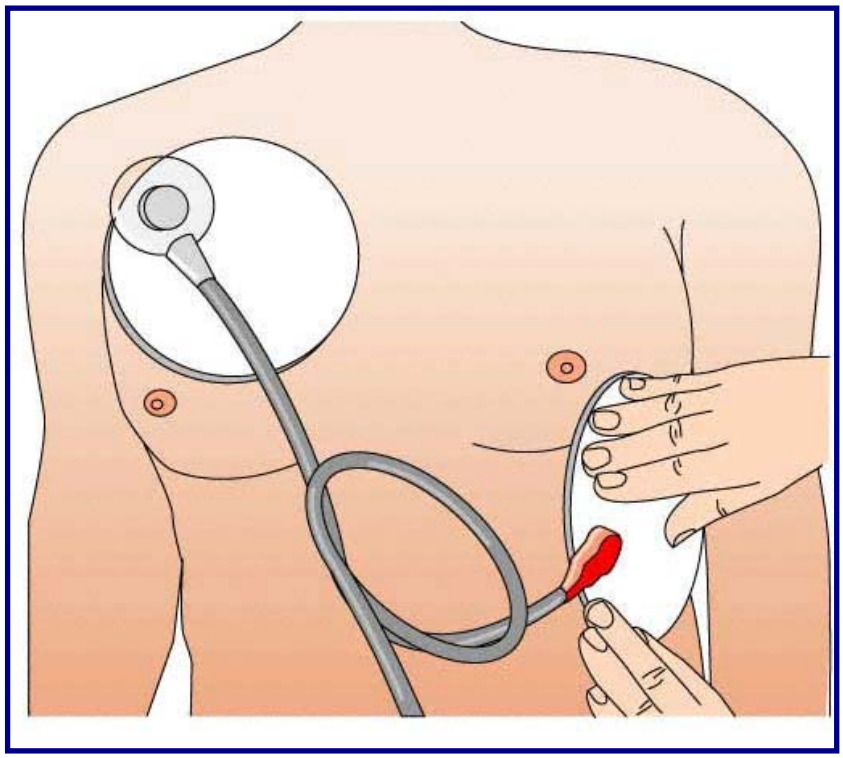


Figure 8-3. Proper placement of electrode pads.

(2) Ensure the pads are attached to the patient cables and that the cables are attached to the AED.

(3) Do not apply the AED pads over transdermal medication patches, implanted defibrillators, or pacemakers.

(4) For a patient with excessive chest hair, shave the areas under the pads before application.

h. Stop CPR.

NOTE: The AED will usually provide prompts for the proper sequence.

i. State aloud, “Clear the patient.”

(1) Once this is stated, look around the patient and make sure that no rescuer is still in contact with the patient.

(2) Look to ensure that the patient is not in contact with water or any other source of conduction that may cause you to be electrocuted by the defibrillator.

j. Push the analyze button.

NOTE: Do not touch or ventilate the patient during the analyze sequence.

k. If advised to do so, push the shock button.

NOTE: Before pushing the shock button, clear the patient again by verbalizing, “Clear the patient,” and visually verify that all rescuers and equipment are away from the patient.

l. After the shock is delivered, begin CPR.

(1) Begin chest compressions at a cycle of 30:2.

(2) Conduct 5 cycles of 30:2 (about 2 minutes of CPR) and then assess for adequate pulse.

(3) If an adequate pulse is detected, monitor the patient as described in paragraph 8-3. If an adequate pulse is not detected, repeat the defibrillation sequence.

m. Repeat the defibrillation sequence, if needed. Repeat the sequence of analyzing, shocking, and five cycles of CPR until on of the following occurs:

(1) Six shocks have been delivered.

(2) A “no shock advised” is issued by the AED

(3) The patient has a return of adequate spontaneous pulse.

n. Prepare the patient for immediate transport if.

(1) The patient has return of adequate pulse.

(2) Six sets of shocks have been delivered.

(3) The AED advises “no shock advised” and the patient is still pulseless.

8-3. CARING FOR A PATIENT AFTER THE AED DELIVERS ITS SHOCK

a. If the patient has regained a pulse:

(1) Assess for adequate breathing and treat appropriately with assisted ventilations with supplemental oxygen or with just supplemental oxygen.

(2) Prepare the patient for transport.

(3) Monitor the patients pulse every 30 seconds in case the patient returns to a pulseless state and CPR is needed.

b. If the patient does not have a pulse and the AED indicates that no shock is advised:

(1) Continue CPR at 30:2 for five cycles (about two minutes) and then reassess the pulse.

(2) Prepare the patient for transport.

c. If the patient does not have a pulse and the AED indicates that a shock is advised.

(1) Clear the patient.

(2) Press the push to shock button to deliver the shock.

(3) Resume CPR at 30:2 for five cycles and then reassess the pulse.

8-4. CARDIAC ARREST DURING PATIENT TRANSPORT

a. Stop the vehicle.

b. If the AED is not immediately available, perform CPR until it is.

c. Analyze the rhythm.

d. Deliver shock if indicated.

e. Continue resuscitation.

8-5. MAINTAINING AN AUTOMATED EXTERNAL DEFIBRILLATOR

a. Read the operator's manual.

b. Get a checklist from the manufacturer.

c. Check the AED and battery at the beginning of each day.

d. Report any failures to the manufacturer and the Food and Drug Administration (FDA).

Continue with Exercises

EXERCISES, LESSON 8

INSTRUCTIONS: Circle the letter of the response that BEST completes the statement or BEST answers the question. After you have completed all of the exercises, turn to "Solutions to Exercises" at the end of the lesson exercises and check your answers. For each exercise that you answered incorrectly, reread the material referenced after the solution.

1. Why is early activation of EMS an important step in the chain of survival?

   a. Only EMS can administer effective CPR.

   b. Only EMS can use an AED.

   c. EMS can bring defibrillation to the patient with in 10 minutes.

   d. The patient will not survive unless EMS arrives to treat them.

2. What is the proper placement of the AED pads on the patient's chest?

   a. One to the right of the sternum just below the clavicle; the other on the left chest with the top of the pad 2-3 inches below the armpit.

   b. One to the right chest with the top of the pad 2-3 inches below the armpit; the other on the left chest with the top of the pad just below the clavicle.

   c. One pad on the front of the chest in the center of the sternum and one pad in the center of the back.

   d. One to the right of the sternum just below the clavicle and directly over a pacemaker; the other on the left chest with the top of the pad 2-3 inches below the armpit.

3. What is your first action after a shock is delivered?

   a. Wait for the AED to analyze the patient.

   b. Check pulse.

   c. Clear the patient.

   d. Begin CPR.

4. When should the patient be prepared for transport?

   a. When the patient regains an adequate pulse.

   b. After six shocks have been delivered.

   c. When the AED advises “no shock.”

   d. When any of the above occurs.

5. What is the first step in treating a patient who becomes pulseless during transport?

   a. Begin CPR.

   b. Push the analyze button on the AED.

   c. Stop the vehicle.

   d. Drive faster.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 8

1. c (para 8-1a)
2. a (para 8-2g(1))
3. d (para 8-2l)
4. d (para 8-2n)
5. c (para 8-4a)

End of Lesson 8